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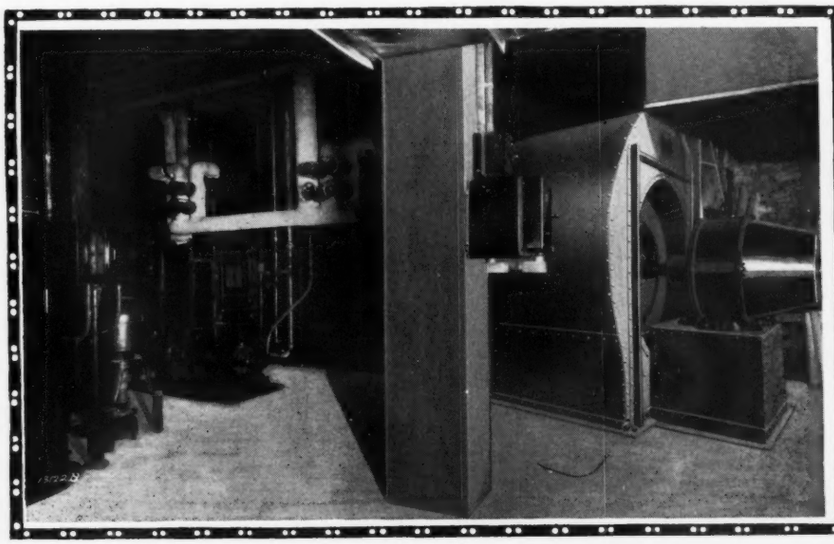

Clarage Air Washers installed in Chicago Trust Bldg. Chicago, Ill.

Four Clarage Fans and two Air Washers are at work in this building.

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The Future of Heating as Seen by the Gas Men

Significance of the Changing Domestic Fuel Situation and Its Eventual Evolution Through the Use of Liquid and Gaseous Fuels

By J. E. Bullard

NOT ONLY are people losing interest in coal, but strong forces are now in operation which will go far toward changing this country from one where solid fuel is used for house-heating purposes to one where liquid and gaseous fuels will be used. Heating men are already perfectly aware of what is taking place in the oil field. The oil companies are pushing the sale of furnace-oil to homes with greater and greater effort every year. As soon as the burner proposition is more completely solved than it is now, there is evidence that an even greater effort will be made to sell oil to householders.

Hard coal was introduced as a fuel about a hundred years ago. It looked like a permanent domestic fuel, but the demand has increased to such an extent, the price has soared so high, the quality has become so far from uniform and the difficulty of securing an adequate supply has become so great, that people are already turning to other fuels.

MOTOR VEHICLES A FACTOR IN THE OIL SITUATION

There is an ever-increasing demand for motor fuel. The number of motor vehicles in this country is increasing at an amazing rate. There are already nearly four times as many in use in the United States as there were only six years ago. The number of air craft is steadily increasing. It is possible that in years to come the airplane will prove as popular as has the automobile. All this is going to have its effect on the oil supply.

When the price of motor fuel goes up, the oil companies find it profitable to turn more of the oil into that fuel by means of the cracking process. The possibility is that the time will come when all the oil possible will have to be transformed into motor fuel and it may then even be necessary to seek a new source of fuel for airplanes and automobiles.

Eventually it may be necessary to come to alcohol, but before that happens it is probable that not only will oil be called upon to supply all the demand it can, but that as much fuel as possible will be secured from the distillation of coal. In some countries motor fuel now sells for several times what we pay for it in this country and the motor vehicle operator will pay much more for gasoline than any other user of oil can afford to pay.

GAS AS THE EVENTUAL FUEL

All this means that though the oil burners that are being installed to-day may be worn out before the price of oil becomes excessive, the time is almost certain to come when people will have to turn to another fuel. Some of them are already going straight to gas.

The men with the greatest vision in the gas industry are aware of this situation and of this fuel trend. A great deal of research work is being done along the line of the distillation of coal and the gasification of the coke that is left.

REVOLUTIONARY CHANGES LOOKED FOR IN THE GAS INDUSTRY

There is evidence that within a comparatively few years, at least before the oil supply becomes inadequate for domestic purposes, some rather revolutionary changes will have taken place in the gas industry. The development of the chemical industries in this country will give the gas companies a better market for their coal-tar by-product. The demand for benzol as a motor fuel will still more increase the demand for the by-products of the industry. More efficient gas-making machinery, which at the same time costs less to install per cubic foot of capacity, will lower the cost of producing gas.

THE SITUATION AS IT AFFECTS THE HEATING INDUSTRY

The condition is one which is of vital interest to the heating industry. In the case of oil it does not so much matter whether the heating man sells the burners or not. If he finds a good burner and undertakes its sale and installation it means an increase in business and extra profit from that department. If he does not sell oil burners his business does not decrease because these burners as a rule are installed in boilers and furnaces already in the house. Not a very large business is yet being done in boilers especially designed to burn oil, compared with the business done in burners designed to be installed in boilers and furnaces already in use.

In the case of gas the situation is likely to be very dif-

ferent. Those who have given the proposition the most attention are inclined to recommend a boiler especially designed to burn gas. Though there are a great many installations in the country where gas burners have simply been installed in existing furnaces and boilers, the tendency, where manufactured gas is concerned, is away from this practice, especially with the gas companies.

HOW THE GAS COMPANIES MAY CONTROL HOUSE-HEATING WORK

This may lead to one of two sets of conditions. Either the gas companies will come more and more to monopolize the house-heating situation as they have the gas range sales, perhaps going so far as to install complete heating systems, or all the work will be turned over to the heating contractors. It depends to a very great degree upon what the heating contractor does.

If the heating man studies the situation and solves the gas heating problems as well, as if not better, than the gas company engineers can, then it is quite certain the gas companies will turn all the work over to the heating contractors. On the other hand, if the heating contractors and the gas companies do not get together and work out these problems, if the heating man does not study the house-heating situation from the gas point of view, there is danger that the gas companies will reach farther and farther into the house-heating field.

NO STANDARD PRACTICE AT PRESENT IN GAS HOUSE-HEATING

At the present time there are no standard practices in house-heating, with gas. In some instances it is preferable to install gas burners which can be easily removed so coal can be used. This means that a small investment will enable the house-holder to use gas during the Spring and Fall, when its use may prove more economical than coal, and use coal during the coldest weather when the solid fuel is cheaper. A person living in a rented house might even be willing to go to the comparatively small expense required to do this, especially if the burner was of such a type that it could easily be removed and installed in the next house to which he moves.

On the other hand, if a man owns the house in which he lives and has plenty of money, it may be a better proposition to install a gas-fired boiler cross-connected to his coal boiler, to give him all the advantages of an automatically-controlled system and at the same time enable him to keep down his fuel bills by using his coal boiler as an auxiliary during the coldest weather if he so desires.

WHAT THE HEATING INDUSTRY MUST DO TO CONTROL THE SITUATION

It matters not what sort of installation is made, unless the heating contractor makes installations that are as satisfactory, if not more satisfactory, to the customer than those the gas company makes, then the gas company is very likely to take steps to control the business. At the present time the heating man, if he will make a little study of gas-burning boilers, is in a better position to render the best service than is the gas man because he knows more about house-heating.

What the heating contractor does now will determine his future in the heating business. More and more gas companies are giving the house-heating situation serious attention and more and more are selling and installing house-heating boilers. There are still a number, however, which have not yet entered the field. These will eventually be forced to do so on account of public demand for this form of heating unless the heating contractor prepares himself at once to handle the business.

PROSPECT OF A LOWER PRICE FOR GAS

Within ten years there is every indication that gas will be sold for a much lower price than it is being sold for today. Within ten years there is every indication that oil will be selling for a much higher price,—the price is already tending upward. There is no great promise that the price of coal will be materially reduced or the quality improved. Freight rates, wages and operators' profits will have to take a material drop before the price of coal will come down to any great extent.

Within ten years there will be a very great increase in the number of people using oil for house-heating purposes. As the price of oil goes up, more and more people will turn to gas. This means that there is going to be a tremendous business done in gas house-hetting apparatus. Even now, with the cost of gas house-heating in the neighborhood of twice the cost of coal required to do the same amount of heating, a surprisingly large business is being done.

Either the heating contractors or the gas companies are going to get that boiler and burner business and the contracts for installing that goes with it. The business will be large enough to warrant heating men beginning at once to make a very careful study of all gas house-heating apparatus now being placed on the market. It will pay them to learn all they can about everything that is offered them, to test it out and to ascertain whether it is at all suited to the conditions in their communities.

In those towns where the heating contractors have adopted this course, where they are thoroughly informed and are able to handle the individual jobs as well or better than the gas company can, there is every reason to believe there will be little difficulty experienced in making the gas companies see the advantages of turning all the work over to the heating trade.

HOW THE ELECTRIC LIGHTING INDUSTRY OPERATES

A great many electric light companies not only do no wiring but solicit wiring jobs and turn them over to the local contractors. The lighting companies pay the contractor as soon as the work is completed and, if the customer is not in the position to pay cash, collect from him on easy terms.

The gas companies can be brought to handle the gas house-heating situation in the same manner after the experimental stage has been passed if the heating-contractors are in a position to demonstrate to them that it is best to do so. However, unless the heating men do not begin at once to give the gas-heating situation very serious consideration and strive to be as well informed as are the gas men, it is not going to be an easy matter for them to hold this business and if they lose it and the gas companies undertake to install complete heating plants, going to the extent of organizing special companies to handle the work if this becomes necessary, it will prove a serious loss to the heating industry.

GAS INDUSTRY NOW SIZING UP THE FIELD

There is also another angle to consider. The manufacturers of gas house-heating apparatus are not now confining their advertising to the gas man. They are ad-

(*Continued on page* 46)

The Argument for the Slow-Speed Direct-Connected D. C. Motor for Ventilating Fan Drive

By J. L. McK Yardley
General Engineer, Westinghouse Electric & Mfg. Company

THE electrical manufacturers' part in ventilating engineering is to supply motors and control which will drive fans, at speeds determined by the fan builders, to deliver air in quantities and at pressures specified by the architect or engineer. That this should be done as economically as is possible, or as is consistent with specified results, goes without question:

The task of reconciling apparently inherent differences between relatively higher speed motors and slow-speed fans has been comparable to other familiar engineering problems, such as accommodating the highly-efficient steam turbine at high speeds to the highly-efficient A. C. or D. C. generator at moderate speeds or to the highly efficient ship propeller at slow speeds.

It is fundamental that electrical motors of sizes such as are ordinarily employed with fans must operate at moderately high speeds to be economical, both as to first cost and to operating efficiency, and, in the case of A. C. motors, to have a reasonably high power factor.

On the other hand, in the past, the corresponding fans, to have high efficiency, have been built only at considerably lower speeds. This has resulted in belted or geared drives, (Figs. 1 and 2) or, where quiet and variable speed operation were requisites, in more expensive slow-speed, directly-connected, direct-current motors. (Figs. 3, 4 and 5).

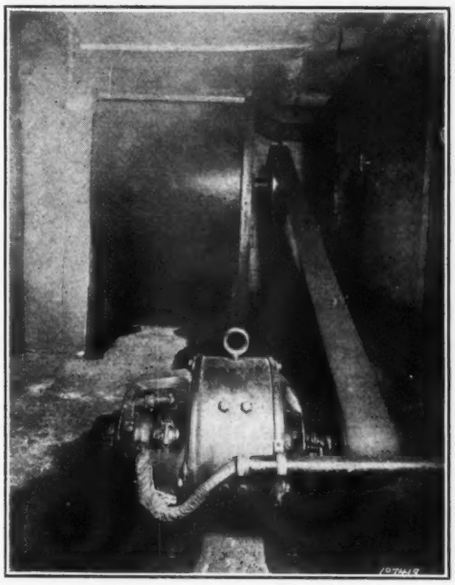


Fig. 1—7 1/2 H. P., 975 R. P. M. Direct-Current Motor Belted to Supply Fan, Weinbro Building, Brooklyn.
This illustrates a condition where space permits the use of a high-speed motor, driving fan through belt.

HOW MOTOR RATINGS HAVE INCREASED

An advance in an art, or field of engineering, which is truly of advantage from an electrical point of view, as it is practically from any point of view, is one which enables a result to be obtained with less special apparatus, with apparatus which may be manufactured in quantity for this application, or, preferably, for this and many other applications as well. The developments in recent years in fan manufacture, particularly in regard to increasing normal speeds and reducing again the tendency to overload or underload under resistance conditions different from normal, have materially increased the number of fan applications which may now be directly driven by standard motors.

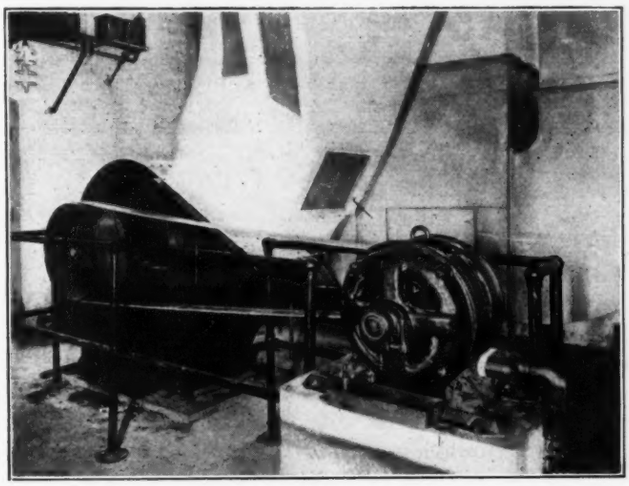


Fig. 2—Main Exhaust Fan, Public School 56, Bronx, New York, Driven by 5 H. P., 8-pole, Constant-Speed Induction Motor.
An installation especially suitable where conditions permit constant speed operation and where with belting of fan the speed may be accommodated to a standard constant-speed induction motor.

To meet all the conclusions of ventilating engineers, as to H. P. and speed required, has necessitated ratings of motors running up into the thousands. One electrical manufacturer, for example, for fan and blower service, has listed in its price form no less than 3,000 different ratings of 230-volt direct-current motors alone, in sizes from and including ½ H. P. to 50 H. P. and for motor speeds extending from 90 to 1050 R. P. M., with speed variation capabilities varying from 1¼ to 1 to 2 to 1 of the respective minimum speeds.

This assortment is due to the requirements of schools and public buildings, for which space and noiselessness requisites have caused direct-connected ventilating units to be specified, the fans of which, until recently, have had an impeller tip speed not over 6500 ft. per minute and have been of a type having a pressure volume characteristic such as demands flexibility in the driving motor, to prevent large overload or underload, when duct resistance conditions differ from normal. It may be said of such requirements that, though often indeterminable in advance with sufficient closeness to permit selection of a driving motor of inflexible characteristics, these requirements are most exacting as they exist unless the equipment installed is flexible enough to permit

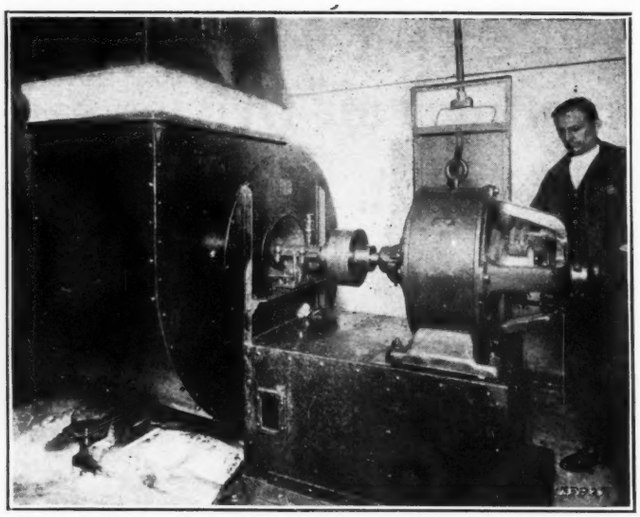


Fig. 3—Supply Ventilating Fan with Direct-Connected Motor, Basement of Hotel Ambassador, New York.

adjustment to meet the pressure volume and noiselessness conditions actually required, dissatisfaction of some kind is bound to be expressed.

It is indeed difficult to see how we are to get away from having a fairly large number of motor ratings for ventilating fan service and particularly how we are to get away from the very general employment of direct-connected variable-speed direct-current motor drive for ventilating fans in schools and public buildings, since they are most satisfactory in every way except cost. Personally, I have some hope that this may come about in the future through some type of gear which while being practically noiseless will be sufficiently inexpensive to be applicable, in connection with standard squirrel-cage induction motors.

Could pressure and volume conditions be definitely predetermined, or enough leeway in output of ventilating units be permissible, we might then consider doing away with variable-speed equipment for many more applications than at present, and in such applications might select a fan having as nearly as possible the pressure-volume characteristics desired, run at a speed such as obtainable by direct connection to a squirrel-cage induction motor at 865, 690, 576, 493, 432, 384, 345, 288, 230, 216, 173, 144, 123, 115 R. P. M., corresponding to 8, 10, 12, 14, 16, 18, 20, 24, 30, 32, 40, 48, 56, 60 poles.

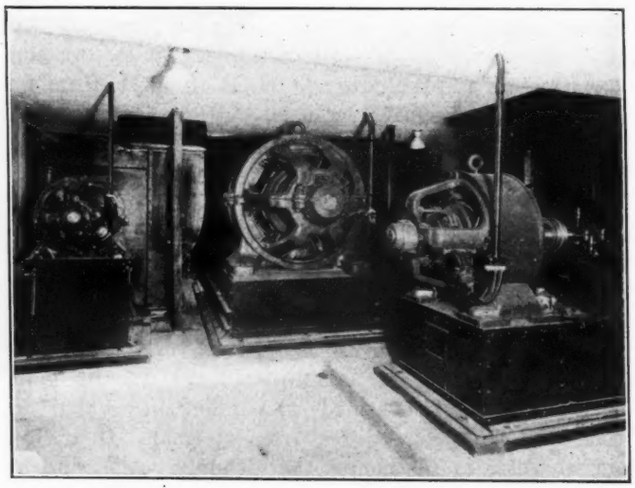


Fig. 4—Exhaust Ventilating Fans, Roof of Hotel Ambassador, New York.
Illustrating the limited space requirements which make slow-speed direct-connected motors necessary.

However, we do not find many manufacturers producing standard motors of this type of less than 7½ H. P., built for less than 576 R. P. M., owing to the poor performance in efficiency and power factor and the greater physical dimensions and weight which are experienced as speeds are reduced.

In regard to physical dimensions, take for example the 15 H. P. 440 or 220-volt, 3-phase, 60-cycle motor, nearly the slowest standard speed for which is 690 R. P. M., corresponding to 10 poles. This is built on a laminated iron core of about 12½ in. internal diameter, and a 5 in. length. If, for example, it were desired to build this at 288 R. P. M., corresponding to 24 poles, it would be necessary to build it on at least a 20 in. diameter and 4½ in. length core, or possibly a 30 in. diameter and 2⅛ in. length core.

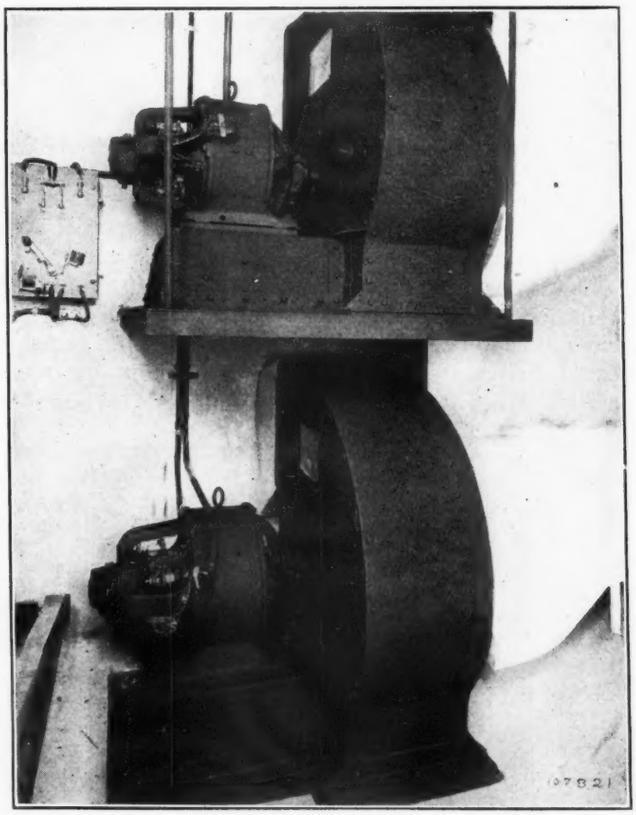


Fig. 5—1 H. P. and 1 1/2 H. P. Direct-Current Motors Direct-Connected to Supply Fans, Bowery Branch, Y. M. C. A., New York.
Another illustration of limited space requirements which preclude the use of belts and make it necessary to place one unit directly above the other.

HOW POWER FACTOR INCREASES WITH SPEED REDUCTION

The matter of power factor itself, becomes prohibitive if speed reduction is carried very far. Fig. 6 shows how power factor varies even among standard motors depending upon the load and speed. For example, a 25 H. P. motor having an efficiency around 85% will take 23.85 K. V. A. at full load from the line, if built on 4 poles, and 29.65 K. V. A., if built on 16 poles; that is, it takes 25% more K. V. A. and consequently

requires 25% larger supply lines and supply generators. On standard motors the air gap is decreased as the number of poles is increased, for the purpose of holding down the ratio between the magnetizing K. V. A. and the K. W. load. Since the air gap can not be made smaller than a certain minimum, a point is soon reached beyond which the ratio of magnetizing K. V. A. to K. W. load increases rapidly. On this account, synchronous motors have been considered for this service; but they have not been employed, as their cost would be high in small sizes, particularly in view of the pull in torque requirements. (Fig. 7).

It may be interesting to consider what would happen practically if the attempt were made to carry the reduction of speed for squirrel-cage motors to the very limit. This is shown by the following table, and the accompanying discussion:

Biggest H. P. standard motor built on approx. same frame diameter.

Poles	R.P.M.	H.P.	P.F.%	Eff.%	H.P.	R.P.M.
20	345	½	60	50 to 75	5	3400
24	288	¾	50	"	15	3400
30	230	1¼	..	"	30	3400
32	216	..	40	"	..	..
40	173	2	25	"	50	1700
40	"	2½	"	"	100	1700
48	144	3½	15	"	150	1700
56	123	..	10	"	...	..
60	115	5½	8	"	200	..

The 20-pole motor in this table would have an efficiency of perhaps 75% and the 60-pole motor not in excess of 50%. The currents taken by these motors would be from 1½ to 10 or more times those taken by

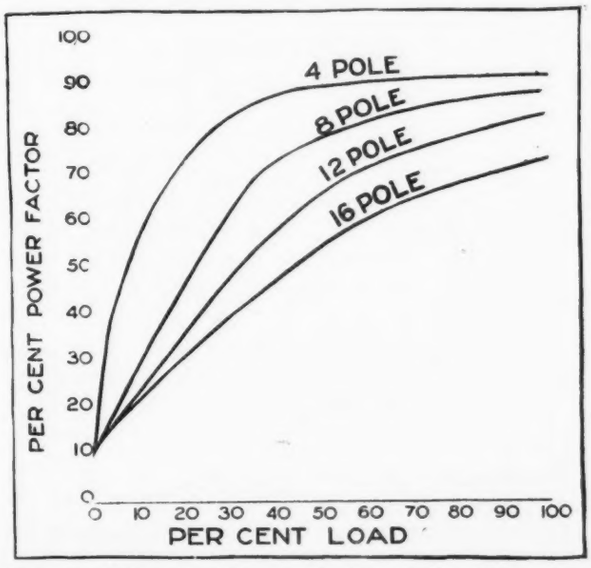


Fig. 6—How the Power Factor Varies Even Among Standard Motors, Depending Upon the Load and Speed.

normal speed motors, and the no load currents would nearly equal the full load currents. The two columns at the right in this table are an indication of how large mechanically the motors indicated in the five columns to the left would be. Large diameters could not be obviated, due to the large number of slots required. As a minimum there must be one slot per pole per phase, that is, three slots per pole for a 3-phase machine. Thus, with a minimum slot and tooth size, the minimum diameter is fixed. Such motors must be heavy because the diameter fixed entails mechanical parts which can not be reduced below certain thicknesses and weights, and be strong.

Leaving out of consideration sizes, weights, and costs due to them and to the low efficiencies, it is apparent that there is no field for motors which for the same H. P. as the standard higher speed motors now manufactured would take ten times or even 1½ times the current input, owing to lower power factors, and require

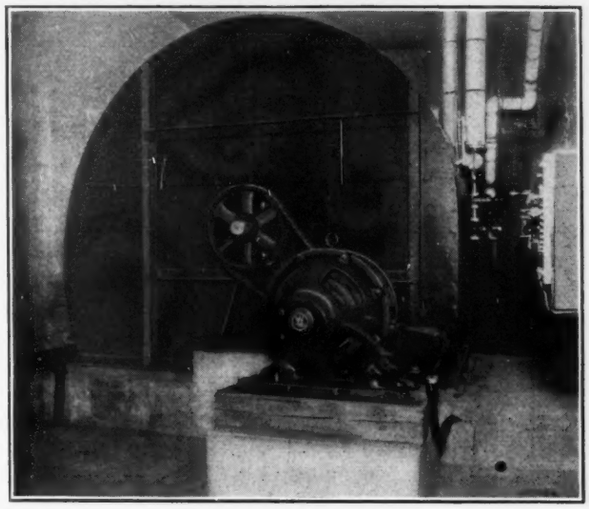


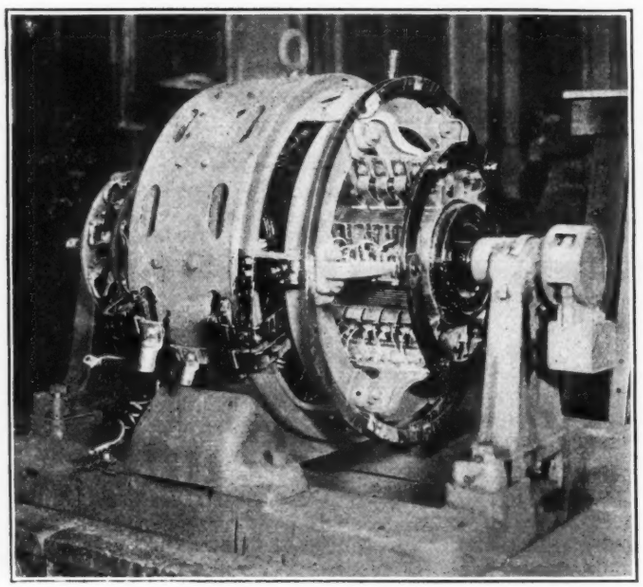
Fig. 7—One of the Main Intake Fans, Syria Temple, Driven by 20 H. P., Three-Phase, 60-Cycle, 220-Volt, 12-Pole, Variable-Speed Alternating-Current Motor.
Illustrating use of link belt to accommodate the fan speed to a standard alternating-current motor speed, for locations where alternating-current only is available and where space is limited and speed-varying characteristics are desired.

supply lines and generating plants commensurate with that input. We can confidently predict that power companies would not permit such motors on their lines in any appreciable quantities and that few people would want to install the copper which would be necessary to carry power within the buildings to them.

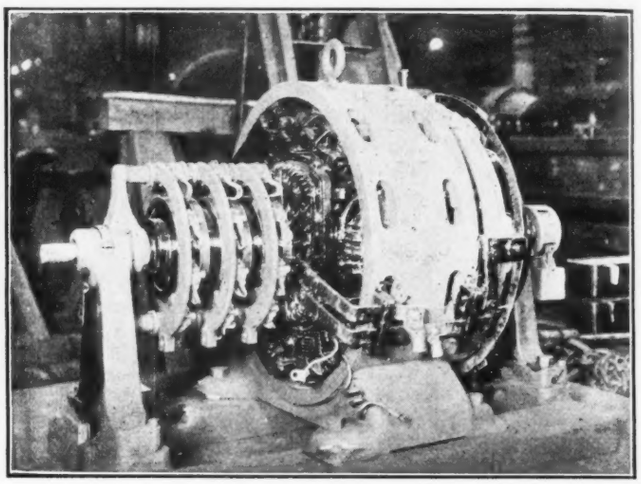
LIMIT REACHED IN REDUCTIONS OF SPEED OF ALTERNATING-CURRENT MOTORS

We come back to the point, therefore, that practically the reduction in speeds of commercially-developed standard types of alternating-current motors cannot be carried very far below those on the market today. Efforts must continue to be directed therefore, towards predetermining pressure and volume condition with greater and greater accuracy, towards designing and employing higher-speed fans where ever they may be economically applied; and, where they may not be, and where belts are not considered permissible, unless some type of reduction gear becomes more generally satisfactory, or some type of alternating current motor, especially suitable for slow-speed operation in small sizes becomes successfully commercially perfected, we must depend in the building industry for ventilating fan drive upon the reliable and flexible slow-speed direct-connected direct-current motor.

Where belts are permitted but speed regulation is required, arguments appear to favor the continued use of direct-current motors, in preference to the polyphase adjustable varying-speed brush-shifting alternating-current motors which have been considered in this connection.



View from Commutator End.



View from Collector-Ring End.

Figs. 8-9. 150-K. W., 250-Volt, 60-Cycle, Commutating-Pole, Synchronous Converter, Suitable for Supply of Direct-Current Motors, Driving Ventilating Fans.

TRANSFORMING ALTERNATING CURRENT TO DIRECT CURRENT

When the total load amounts to 75 H. P. or more the direct current may be readily obtained from alternating-current circuits through conversion by means of a highly-efficient transformer synchronous converter unit. The efficiency of such a unit of 150 K. W. 250-volt, direct-current capacity at full load would be around 91%, as compared to 85% for the corresponding unit of the very generally employed motor-generator type of unit. One such unit the synchronous converter part of which is illustrated in Fig. 8 and 9 of 100, 150 or 200 K. W. capacity could, in many existing installations, undoubtedly be substituted for a number of small motor-generator sets and, owing to its appreciably higher efficiency, particularly at light loads, produce important savings.

In fact, in many large hotels and other buildings of public type where, owing to a large part of the ventilating equipment being necessarily located at the roof, the electrical equipment is split in two or more locations widely separated by say twenty of more floors, it might be considered whether it would not be desirable to split the conversion equipment into two parts, in fact, to have two or more substations converting from alternating current to direct current where necessary and perhaps partly employing conversion equipment of automatic nature as shown in Fig. 10 so as to incur the power losses of operation only when necessary.

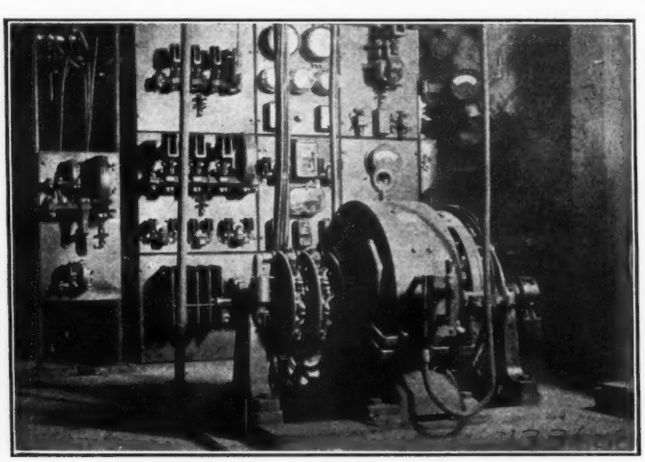


Fig. 10—Automatic Substation, Including Converter, Together with Switchboard Panels for Automatic Control of Motor.

The Future of Heating as Seen by the Heating Men

(*Concluded from page* 42)

vertising to the heating man as well. If it develops that the gas companies buy so much more of this apparatus that the returns from the gas magazine advertising is greater than that from the heating journals, they will use more space in the gas field and give more attention to the gas men, co-operating with them in selling this apparatus. At the present time they are experimenting to a great extent to learn where the most profitable field does lie.

Developments that have taken place in other industries indicate that everyone will profit most, the customers will get the best service in the long run and greater improvement will be made in apparatus if the heating contractors enter this field with so much energy as to control it. If they do this there will always be a market for something new and better. If distribution of the manufacturer's products is confined to too small a number of concerns then it becomes increasingly difficult not only to find a market for something new, but also to educate the people to the points where they will buy it.

Gas today stands about where anthracite coal did a hundred years ago. During the next hundred years there is reason to believe that gas will come to hold a stronger position than any other domestic fuel has ever held. It is highly important, therefore, that those at all interested in house-heating installations should give the question of gas house-heating very serious consideration.

A Short, Practical Method of Designing Gravity Water Heating Systems

With Six Illustrative Problems Frequently Encountered In Practice, and Their Solutions

By F. E. Giesecke

Professor of Architectural Engineering, University of Texas

III—Design of System II

LET it be required to design the pipes lines and radiators for the "one-pipe" system shown in Fig. 7.

This system is intended for a two-story building in which all rooms are to be heated to 70°. The minimum temperature of the air in the basement is assumed to be 50°. The drawing shows the quantities of heat to be delivered to and dissipated by the several radiators. This drawing is intended for use by the engineer in designing the system; the working drawing, from which the installation is to be made, must show also the sizes and kinds of the different pipes and valves and the sizes and types of the several radiators and of the heater and expansion tank.

At first inspection System II seems much more complicated than System I; a little reflection will show that System II may be divided into a major system, designated System IIA and shown in Fig. 8, which is very similar to System I, and ten minor systems, designated System IIB and shown diagramatically in Fig. 9, which are almost identical with System I. Each of the eleven systems is designed according to the method explained for System I. (See February, 1924, issue).

IMPORTANCE OF PROPER PITCH

Beginning with System IIA, we note that this system is made up, essentially, of a pipe line and a heater. The pipe line comprises two short vertical sections, the flow and return risers, and a long section which is practically horizontal and which will be referred to as the "main." The main should be pitched so that all air which may accumulate in it can escape through the nearest riser and so that all water can be drained from the system. The high point of the main should be at the foot of one of the risers. It should not be at the head of either of the risers connecting the main and the heater, unless special provision is made to remove the air which will collect at that point. The pitch of the main is generally 1 in. in 10 ft.: it may be less if the installation is made so carefully that every part of the main will have a slight pitch in the right direction.

ADVANTAGE OF USING SAME PIPE SIZE THROUGHOUT SYSTEM

The pipe line of System IIB may be made up of several sections of different sizes; for the sake of simplicity and ease of construction, the entire line should consist of pipe of one size. It is evident that System IIA will operate whether a large or a small pipe is used; it is also evident that the friction in the circuit is increased as the size of the pipe is decreased, if the quantity of heat delivered to the radiators remains constant, and that the temperature difference of the water in the flow and return risers is increased as the friction is increased.

As this temperature difference is increased, the mean temperature of the water in the main and the mean temperature of the water in the ten radiators is lowered and, consequently, the average size of the radiators increased. In other words, if we reduce the cost of the installation by reducing the size of the pipe in System IIA we automatically increase the cost of the installation by increasing the total radiation required to deliver the specified quantity of heat, 80,000 B.T.U. in this case. There must, consequently, be a certain size of pipe best adapted to each particular system which will insure low cost of installation and satisfactory operation. This size can be found only by trial; i. e., by making several designs and selecting that size which seems best suited to the particular case.

THE FIRST STEP IN DESIGNING SYSTEM IIA

We may now proceed with the design of System IIA. Let us begin by assuming that the water is to leave the heater at 200° F and return at 180° F.

The pressure-head is, from Diagram I, 4 x 90 or 360 m. i.

The circuit consists of 105 ft. of pipe, seven elbows, and one heater; its friction, therefore, equivalent to that due to 105 ft. of pipe and ten elbows.

Assume a 3 in. pipe; the friction-head is, from Diagram III,

$$\begin{aligned} 105 \times 3.1 &= 326 \\ 10 \times 16.2 &= 162 \quad 488 \text{ m. i.} \end{aligned}$$

or 128 m. i. more than the available pressure-head.

Assume a 3½-in. pipe; the friction-head is

$$\begin{aligned} 105 \times 1.5 &= 158 \\ 10 \times 8.1 &= 81 \quad 239 \text{ m. i.} \end{aligned}$$

or 121 m. i. less than the available pressure-head.

A 3-in. pipe is, therefore, too small and a 3½-in. pipe is too large if a temperature difference of 20° is to be attained.

By proceeding as described for System I and illustrated in Fig. 2, we find that System IIA will operate with a temperature difference of 23° if a 3-in. pipe is used and with a temperature difference of 18° if a 3½-in. pipe is used.

SELECTING THE PIPE SIZE

To see how we can affect the cost of the entire system by choosing between a 3-in. and a 3½-in. pipe for System IIA, let us assume that the labor cost for installing a 3-in. line would be the same as that of installing a 3½-in. line; the cost of the 3-in. pipe with fittings and covering would then be about $25.00 less than that of a corresponding 3½-in. line. The resulting increase in the cost of the radiation would be about $8.00, as shown by the following calculation:

For a 3-in. pipe the mean temperature of the water entering the ten radiators is about 200—(23 ÷ 2), or 188.5°. If the ten minor systems are designed so that the temperature drop through each radiator is 20° the mean temperature of the water in the ten radiators will be about 188.5°—10°, or 178.5°, and if the mean temperature of the surrounding air is 70° the temperature difference will be 108.5°. Similarly, for the installation using a 3½-in. pipe, the temperature difference is 111°. These two temperature differences are so nearly the same that we may select the same value of K, from Fig. 3, for the design of the radiators.

The two corresponding radiation quantities will then be proportional to 108.5 and 111. If we assume, as an average value, that each square foot of radiation will dissipate 150 B. T. U. per hour, System II will require 80,000 ÷ 150, or 533 sq. ft. and the additional radiation, necessitated by the use of 3-in., instead of 3½-in. pipe, would be about (533 ÷ 111) x (111—108.5), or 12 sq. ft. The cost of this additional radiation would be about $8.00, if we assume that the labor cost of installing the ten radiators would not be increased by the slight increase in the average size of the radiators.

The net reduction in the cost of System II, due to the use of 3-in., instead of 3½-in. pipe, is about $17.00 and we would select the 3-in. pipe. Since this difference in cost is so small it is probably not necessary to investigate the desirability of using 2½-in., instead of 3-in. pipe.

DISSIPATION OF HEAT BY THE PIPES A FACTOR

In all cases considered so far we have neglected the effect of the dissipation of heat by the pipes in the several radiator circuits. This is not permissible in the case of System IIA. To study its effect we note from Diagram III that the velocity of the water in the 3-in. pipe is about 4.25-in. per second. The water will, therefore, require 105 × 12 ÷ 4.25, or 296 seconds to flow from the heater through the 105 ft. of 3-in. pipe back to the heater. During this time it would experience a drop in temperature of 8.8°, which we determine as follows:

We note from Table II that for a 3-in. pipe 1.091 ft. are required to provide 1 sq. ft. of external surface; if we assume the value of K for a single horizontal bare pipe to be 2.6, the heat dissipated by the 3-in. pipe in 296 seconds will be

$$\frac{105 \times 296 \times 2.6 \times (188.5 - 50)}{1.091 \times 3600} \text{ or } 2850 \text{ B.T.U.}$$

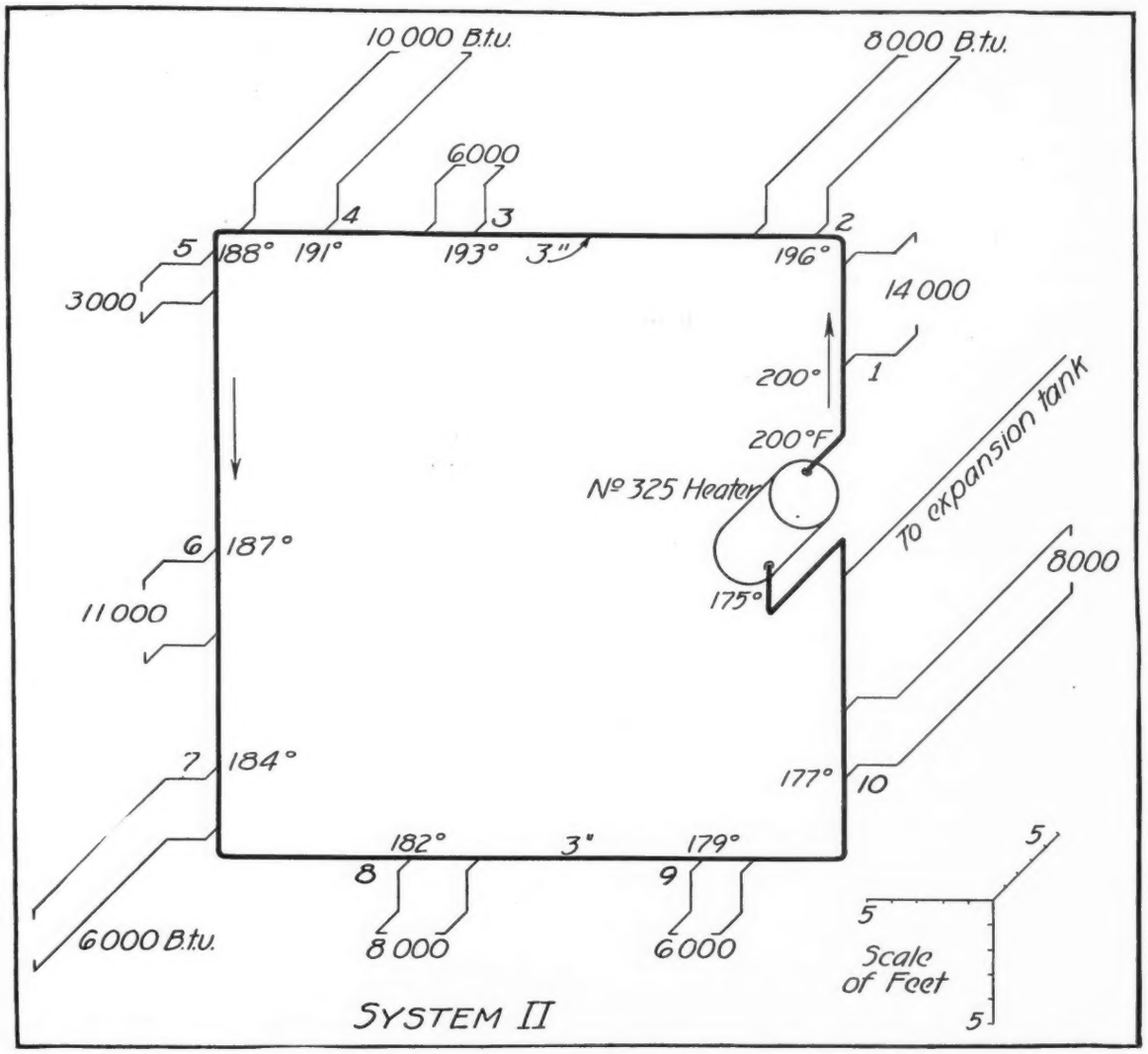


Fig. 7. A One-Pipe Heating System for a Two-Story Building

We note also from Table II that for a 3-in. pipe 19.5 ft. are required to contain 1 cu. ft.; if we assume the mean density of the water in the 3-in. pipe to be 60.40, the quantity of water required to fill the 3-in. pipe is $\frac{105 \times 60.40}{19.5}$ or 325 lbs. This is the quantity of water which is losing the 2850 B.T.U. calculated above; in doing so, its temperature will be lowered 2850 ÷ 325, or 8.8°. This is in addition to the cooling of 23° on account of the 80,000 B.T.U. per hour, delivered to the ten radiators. The heat dissipated by the 3-in. pipe in the basement would therefore be 8.8 ÷ 23, or 38% of that specified for the ten radiators in the building proper. This proportion is entirely too large and the 3-in. pipe should be well

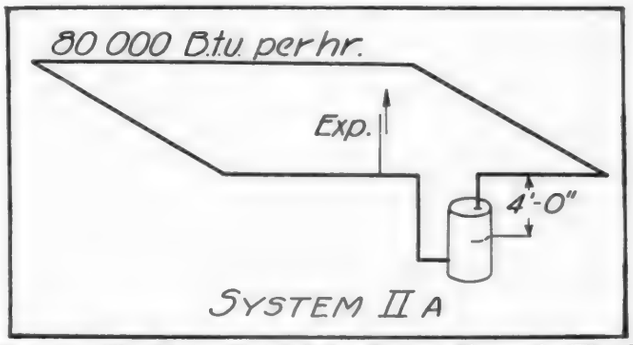


Fig. 8. The Major Unit of the System Shown in Fig. 7

insulated. The heat loss from a pipe insulated with a good type of pipe covering is only about one-fifth that of the bare pipe.

We will assume that the pipe in System IIA is well insulated and that the drop in temperature, due to its own heat dissipation, is 2°. In that event, water leaving the heater at a temperature of 200° will return at a temperature of 175°. The 23° drop in temperature will be distributed along the main practically in proportion to the heat dissipated by the several radiators. The 2° drop in temperature will be distributed along the main at a practically uniform rate. It is sufficiently accurate, however, to assume that the 2° drop in temperature will be distributed in proportion to the 23°, i. e., according to the heat dissipated by the several radiators. This rate of distribution can be determined most easily by a sketch like that shown in Fig. 10.

DETERMINING HOW THE HEAT LOSS IS DISTRIBUTED

To prepare such a sketch, draw a triangle so that, to some convenient scale, the horizontal side represents the total heat dissipated by the radiators, 80,000 B. T. U., and the vertical side represents the total drop in temperature in the main, from 200° to 175°. Then set off, along the horizontal side, the successive quantities of heat dissipated by the several radiators in the order in which they are reached by the water coming from the heater; i. e., first, 14,000, second, 14,000 plus 8,000, or 22,000, etc.

From the division points thus determined draw vertical lines to the inclined side of the triangle and from the points there found draw horizontal lines to the vertical side of the triangle and read the temperature of the water in the main at the several points of connection to the flow risers of the radiators.

DESIGNING THE TEN MINOR SYSTEMS

We are now ready to design the ten minor systems shown diagrammatically in Fig. 10. Before undertaking this we must understand clearly the nature of the forces which tend to make the water flow through the radiators and the nature of the forces which resist such a flow. Consider the system shown in Fig. 10. As the water which circulates in the main reaches the point A, a portion of it will flow from A to B by the short and direct path along the main, and the remainder will flow from A to B by the long and indirect path leading through the radiator. If the two paths leading from A to B offered equal resistance to the flow of water each path would convey an equal volume. Since, ordinarily, the frictional resistance of the path leading through the radiator is much greater than that of the short and direct path along the main, by far the smaller portion of the total volume tends to flow through the radiator.

By referring to our calculation relating to the 3-in. main, we note that the frictional resistance of the 3-in. pipe is 3.1 m. i. per foot. If the distance from A to B is 3 ft., the frictional resistance from A to B would be 9.3 m. i. (if the entire volume of water were flowing along the main). Consequently the force exerted by System IIA to cause the water to flow from A to B, by the double path available, is 9.3 m. i. This is an extremely small force. For that reason some engineers never make the distance A-B less than 5 ft.; particularly not in forced circulation systems.

However, after the system is in operation and the flow riser is filled with hot and the return riser with cooler water, there is an additional force which tends to make the water take the long and difficult path through the

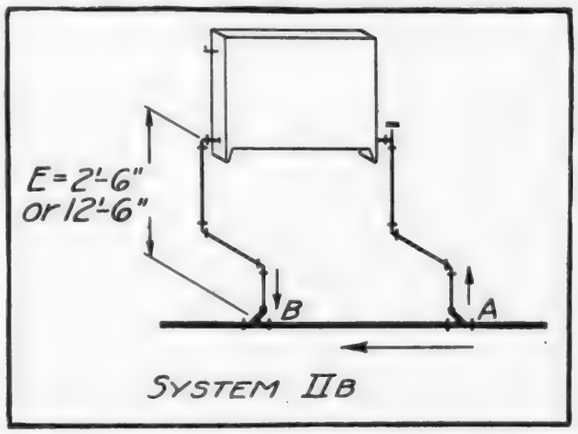


Fig. 9. The Minor Units of the System Shown in Fig. 7

radiator, rather than the short and easy path along the main. If a 20° temperature difference exists between the water in the flow and return risers, the pressure head due to the same is about 80 m. i. per foot of riser. The head tending to make the water flow through the first story radiators would then be 2.5 x 80, or 200 m. i. and that tending to make it flow through the second story radiators would be 12.5 x 80, or 1000 m. i.

These heads are very large in comparison with the head of 9.3 m. i., calculated above as the partial pressure-head in System IIA, acting between the points A and B. In our calculations, relating to gravity flow system, we shall neglect the small force acting between the points A and B and due to the pressure-head of Systems IIA and con-

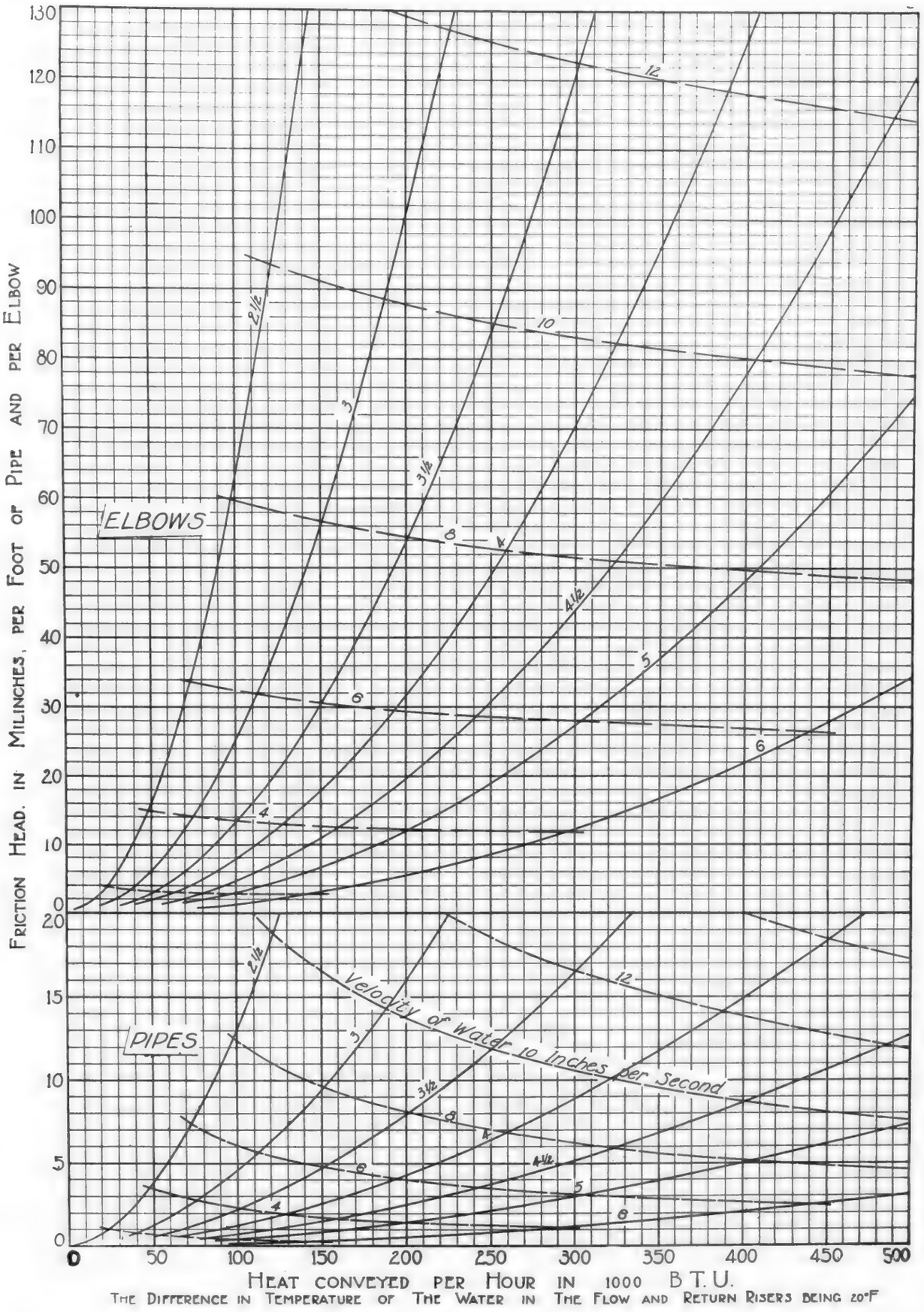


Diagram III.—For Finding Friction Heads in Pipes and Elbows

sider only the pressure-head due to the minor System IIA; we shall do this because our calculations are simplified thereby and because the resulting error is on the side of safety. In forced circulation systems this approximate method should not be used.

FORCES WHICH RESIST WATER FLOW

There are two forces which resist the flow of water through the radiator. The principal one is the friction in the radiator circuit. This, in the case of System IIB, is due to 2 Y-branches, 5 elbows, 1 valve, 1 radiator, and 10 or 30 ft. of pipe, respectively for the first and second-story radiators; or an equivalent of about 14 elbows and 10 or 30 ft. of pipe, respectively, for the two cases.

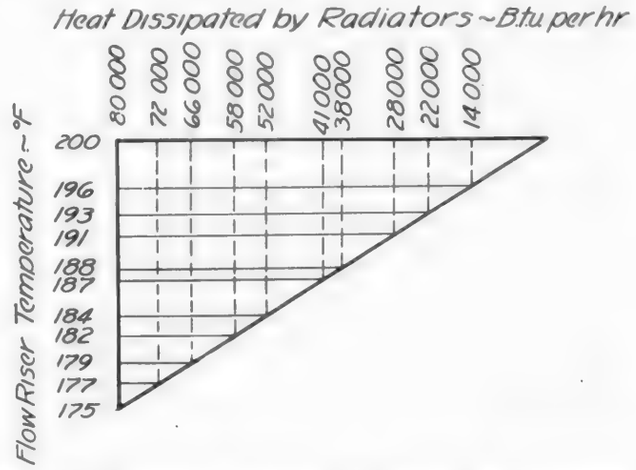


Fig. 10. Graphical Method of Finding Temperature-Gradient of the Water in the Main of System II

The second and minor force which resists the flow of water through the radiator circuit is due to the inertia of the water flowing in the main; when the water reaches the point A its inertia tends to make it continue in its original course toward the point B and a certain force is required to deflect it from that course into the flow riser at A. This deflecting force must be supplied by the forces which tend to make the water flow through the radiator and its effect is, therefore, the same as that of a resistance.

It is quite evident, therefore, that the fittings at A and B should be Y's and not T's. This is particularly true in forced circulation systems in which the water flows with a high velocity and in which a considerable force is required to deflect the water from its straight course in the main and into the flow riser.

The flow riser should always be taken out of the top of the main because that connection will result in filling the flow riser with hot water in the shortest time; after the flow riser is filled with hot water and circulation through the radiator is in progress, a top connection has no advantage over a side connection for the flow riser. The return riser may be connected into the top or into the side of the main. In either case the water coming from the radiator will mingle with that coming from the main and the resulting temperature in the main will be due to the temperatures of the water from both sources. In chosing between a top and a side connection for the return riser, the length of pipe, the number and kind of fittings, and the labor involved in making the connection should be the determining factors.

With these explanations in mind, we will now design three of the ten minor systems: No. 1, the largest, No. 5, the smallest, and No. 10, the last one in the series.

For No. 1 assume a 1¼-in. pipe and a 20° temperature drop; the pressure-head is 2.5 x 90, or 225 m. i.
The friction-head is

10 x 6.2 = 62	
14 x 14.6 = 204	266

or 41 m. i. more than the available pressure-head. Assuming a 30° temperature drop we find the pressure head to be 330 and the friction-head 121 m. i. The system will, therefore operate with a temperature drop of 24°. The mean temperature of the water will be 200—12, or 188°; the temperature difference will be 188—70, or 118°. Hence, from Fig. 3, for a 3-col, 38-in. radiator, K will be 1.32; the heat dissipated by 1 sq. ft. will be 1.32 x 118, or 156 B. T. U; and the required size of a radiator, 14,000 ÷ 156, or 90 sq. ft.

For No. 5 assume a 1-in. pipe and a 20° temperature drop.
The pressure-head is 2.5 x 85, or 213 m. i.
The friction-head is

10 x 1.6 = 16	
14 x 2.2 = 31	47 m. i.

For a 10° temperature drop
The pressure-head is 2.5 x 44, or 110 m. i.
The friction-head is

10 x 5 = 50	
14 x 8.5 = 119	169 m. i.

System No. 5 will, therefore, operate with a 1-in. pipe and a 12° temperature drop.

The mean water temperature in the radiator will be 188—6, or 182°; the temperature difference will be 182—70, or 112°; the value of K for a 3-cot. 38-in. radiator, 1.3; the heat dissipated per square foot will be 1.3 x 110, or 143 B. T. U.; and the required size or radiator, 3000 ÷143, or 21 sq. ft. We would select a 4-sec., radiator, having 20 sq. ft. which, on account of its small number of sections, has a higher value of K than that found above. (See Fig. 5.)

For No. 10, assume a 1-in., pipe and a 20° temperature drop.

The pressure-head is 12.5 x 80, or 1000 m. i.
The friction-head is

10 x 8.4 = 84	
14 x 15.6 = 218	302

For a 15° temperature drop
The pressure-head is 12.5 x 60 or 750 m. i.
The friction-head is

10 x 14.2—142	
14 x 28 = 392	534 m. i.

No. 10, therefore will operate with a 1-in., pipe and a 14° temperature drop.

The mean water temperature in the radiator will be 177 — 7, or 170°; the temperature difference will be 170 — 70, or 100°; the value of K, for a 3-col., 38-in. radiator, 1.27; the heat dissipated per square foot will be 1.27 x 100, or 127 B. T. U.; and the required size of the radiator 8000÷127, or 63 sq. ft. We would select a 13-sec. radiator having 65 sq. ft.

The next section will explain the design of a simple two-pipe system

Back To First Principles

Plain Answers to Direct Questions on Present-Day Heating and Ventilating Practice

By T. W. Reynolds

(*Continued from the March issue*)

Although many of the topics presented in this department will be familiar, no doubt, to our readers, we dare say their discussion from the standpoint of the principles involved, will be found interesting reading and may help to refresh the memories of many who have taken things for granted when it came to the operation of a given apparatus or appliance. Even the more experienced engineers, it is hoped, will at time find suggestions here which will of an practcal value to them.

So far as possible, the questions and answers are arranged in logical order. The form adopted of question and answer will serve as a ready reference for the numerous details encountered in the design and construction of heating and ventilating systems.

25. Q. What is the proper way to make connections to pipe coils of various types so as to decrease liability to air-binding and where should the air valve be placed?

A. With the return bend type of coil, shown in Fig. 13, the steam flows through the pipes in series, so that there is less liability to air binding. In this case, the air valve should be located according to theory, at the low point, never at "A," but instead well away from the path of the water.

For other types of pipe coils, such as the manifold or header type, it is not quite so easy to determine the best location for the air valve, because the air does not always accumulate at any one place. Instead, it may diffuse over a large area, due to high entrance velocity of the steam and small difference in densities of the air and steam. As evidence of this, pipe coils may sometimes be observed with two or more air valves located at various points on the coils.

In general, it may be said that with a coil properly designed and connected, the air valve should be placed near the bottom of the return header, as in Fig. 14, be-

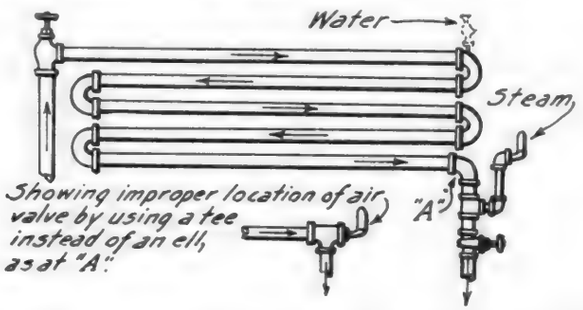


Fig. 13. Method of Relieving Air From Return Bend Coil

cause the air (being heavier than the steam) settles to the bottom of the coil. Proper design in this case means a supply header with internal diameter of large size, at least 2½ in., dependent upon the length of header. This reduces the entrance velocity of the steam, allowing the pressure to equalize throughout the header. Of course, if the supply connection is made as shown in Fig. 15, or as shown dotted in Fig. 16, the steam tends to travel faster through certain pipes of the coil and close the air valve before the air in the slower operating pipe is expelled. However, if such connections are used, a deflector placed in front of the inlet will help in distributing the steam equally to all pipes.

Some engineers make the location of the air valve dependent upon the direction in which the steam enters the supply header. According to this theory, steam in entering one end of the supply header produces a pull in the nearer pipes while passing these pipes and also increases the pressure at the opposite end of the header, due to the velocity of the steam being stopped at this point. The combined result of these things is a rotary motion of the steam and air within the coil, as shown in Fig. 14. Then, as the steam condenses each side of the air pocket, more steam will take its place, so that the air lock continues in definitely.

Much the same line of reasoning is followed in Fig. 15. In this case the air valve is placed near the top of the return header. This is done also in the case of a pipe coil with connections as shown in Figs. 16–17, the idea being to prevent premature closing of the air valve, as the entrance velocity might cause the steam to take the path shown by the arrows. Continuing this reasoning, the position of the air valve would be reversed where the connections are as shown in Fig. 18.

Sometimes orifices are also used to prevent the difficulties in mind. Such devices establish an excess pressure in the supply header which equalizes the flow to each pipe and causes the entire coil to fill up evenly, the size

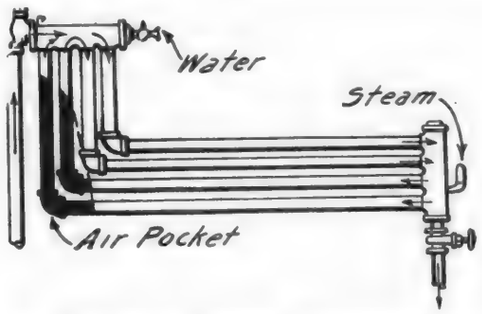


Fig. 14. Method of Venting Miter-Type Pipe Coil

of contractions being made so that each pipe will be filled with steam according to its normal rate of condensation. In this way, only the proportionate share of steam will be received by each pipe and no more. Just how this may be done is shown in Fig. 19, bushings or so-called fixed orifices having bored openings of about ¼ in. or less (according to conditions) being inserted in each pipe of the coil.

Another method of reducing the entrance velocity is to use double-pipe supply connections, sometimes with a split-return header, as shown in Fig. 20, or if the coil is overhead, flat, and rather wide over seven or eight pipes; with double-pipe return connections, as shown in Fig. 21. However, as previously stated, with proper conditions, the entrance velocity will cause no trouble, so that the air valve should be placed near the bottom of a vertical return header. This is because the air must

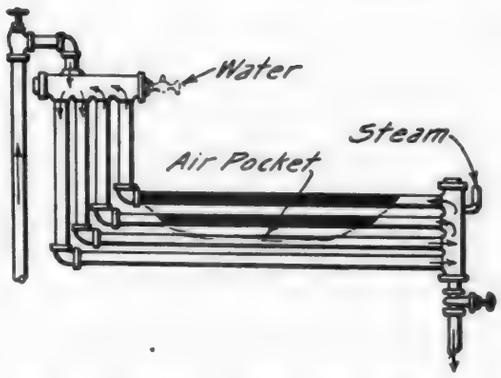


Fig. 15. Air Pocket in Pipe Coil Caused By Wrong Method of Connecting Supply

be compressed by the steam before the steam can drive it through the pin hole of the usual small air valve, and the air cushion so formed checks the velocity in the supply header. Air will then be gradually eliminated from the coil, as shown by diagonal lines in Fig. 18.

It is a different matter if large quick-venting air valves are used on coils, as there is then no air to cushion

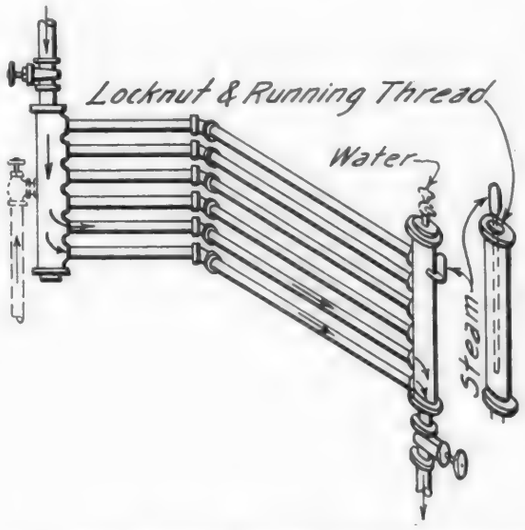


Fig. 16. Corner-Type Pipe Coil With Short Circuit Due To High Eentrance Velocity

the entering steam. Going a step further, we might use large vents on the mains in order to quickly relieve the air in the piping system and ordinary radiator valves

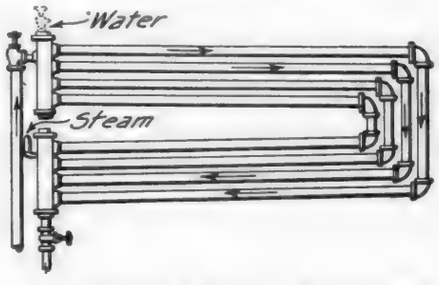


Fig. 17. Venting a Return Branch Tee Coil

on the radiating surfaces, so that only the air within the coils need be discharged through the small air valves. So we progress to vapor or vacuum systems in which air is quickly removed through the returns, and vented, either by means of one large trap near the boiler (as in the vapor system), or else by means of an open tank receiving the discharge of the vacuum pump (as in the vacuum system). In such cases, the velocity of steam entering the coils is somewhat greater and double-pipe connections are more frequently used for the larger coils.

In the case of ceiling coils with single connections, the connections should be made at "A" and "B" (See Fig. 21) for better pitch or drainage and efficient circulation within the coil. The return connection may be made,

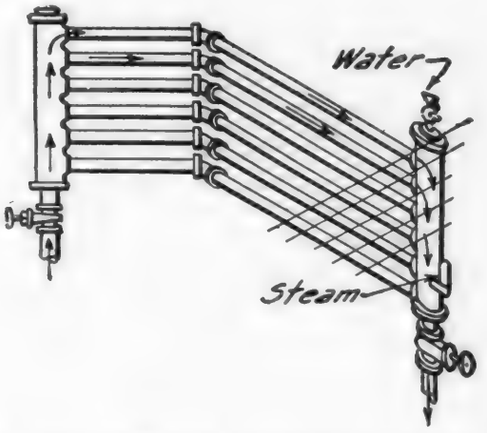


Fig. 18. Proper Method of Venting Corner-Type Coil

either by means of the bottom connection shown dotted, or else by means of a reducing ell or eccentric bushing, so as to properly drain the coil. For steam, other than vapor or vacuum heating, an air valve with bottom connection should be used, located preferably on the top of the header close to "B," for, if placed in either end or tapped in the side of the header, it might lie in the path of the water.

This point should also be considered in connection with a coil having a vertical return header, as water will cling to the inside perimeter of a vertical header. Instead of

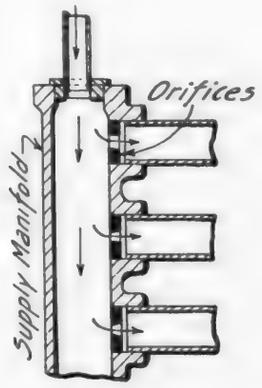


Fig. 19. Pipe Coil Supply Header With Orifices For Even Distribution of Steam

tapping the air valve into the side of the header, it is better to use an air valve with bottom connection placed at the top of the header, as detailed in Fig. 16. This should be connected to a pipe (preferably ⅜ in., where

the internal diameter of the header will permit) and the pipe extended well down inside of the header to the point where the air collects.

As for water heating, the air valve should always be located at the top of the coil away from the inlet, as shown dotted in the sketches.

26. *Q. What other conditions may cause air-binding in radiators?*

A. Steam in flowing through pipes and fittings is subject to a loss in pressure, due to friction, as well as a natural drop in pressure due to condensing of the steam. The greatest pressure loss is at the farthest point from the boiler. As a consequence, radiators connected to a dry return and without some kind of thermostatic trap on their return connections may short-circuit steam at higher pressure into the return through some favored or nearer radiator, and then, back-firing to the radiator having the lower pressure, close the air valve of that radiator before the air has been expelled. The air is then pocketed as the steam enters the radiator from two directions (See Fig. 22).

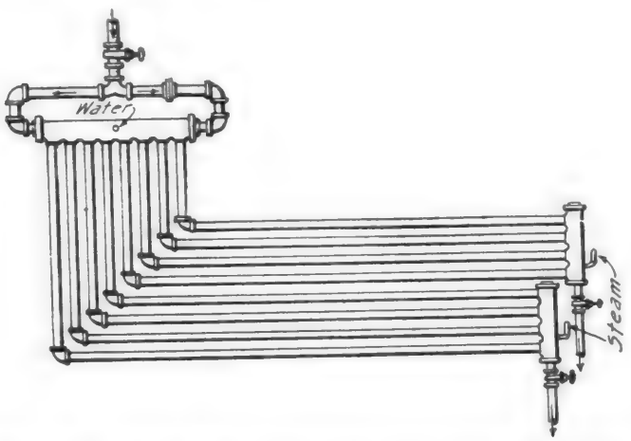


Fig. 20. Double-Pipe Connection For Large Coils Using a Split Return Header

Strickly speaking, it is not correct to say, as is often stated, that the failure of a radiator to heat all over is caused by air binding, because the air tends to leave a radiator or pipe coil if not prevented by improper conditions. The steam supply may be insufficient, water-logging may take place, due to improper drainage or priming at the boiler, or many other conditions may be the cause of the air remaining within the radiating device. Air binding is an effect, not a cause.

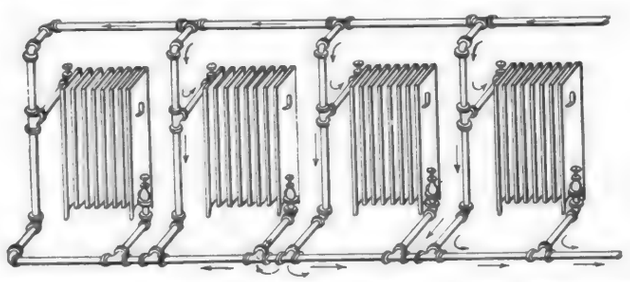


Fig. 22. Air-Bound Radiators Due To Short Circuiting of Steam

(To be continued)

Ventilation Requirements in Areas Occupied by Motor Vehicles

Acute forms of carbon monoxide poisoning are becoming more frequent and generally occur where gasoline motors are allowed to run in any sort of closed area. For this reason, states Arthur L. Greene, of the Buffalo Forge Company, the subject of tunnel ventilation, where motor vehicles are a factor, is becoming increasingly important. In addition, the fact that more tunnels and enclosed passageways of one kind or another are being built to save space and time requirements in congested parts of our larger cities, makes this a subject of concern to every individual.

A practical illustration of the type of city tunnel referred to, wherein mechanical ventilation was found necessary because of the danger existing from exhaust gases, is the street level vehicular tunnel at the Grand Central

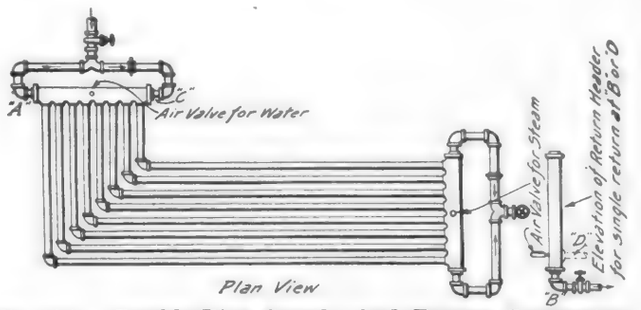


Fig. 21. Double-Pipe Supply And Return Connections For Large Flat Coils

Terminal of the New York Central Railroad, in New York City. This tunnel, or cab-stand, as it is better known, is perhaps 300 ft. in length, has an average head room of 9 ft., 4 in., and is built in the form of a semi-circle. Many hundreds of automobiles enter and leave this are way per hour; the majority of the cars have their engines running while in the tunnel, which means a continuous exhaust of gas. No provisions was made originally for mechanical ventilation of this cab-stand. The atmospheric conditions became so bad, however, that some means had to be taken to get rid of the accumulated gases.

Accordingly a large double-width Turbo Conoidal fan of the Buffalo Forge Company make was installed.

The capacity of the unit is 56,000 cu. ft. of air per minute. Motive power is furnished by a 75 H. P. motor, direct-connected. Inlet guards and outlet dampers complete the equipment. The outlet opening of the fan extends from a distance approximately 3 ft. above the floor-line to the ceiling of the tunnel. The foul air is exhausted by the positive suction afforded by the fan, and the vacuum created draws in the fresh outside air.

The results attained here are aptly illustrated by the following: An air test made by city inspectors in this tunnel or cab-stand showed only 1½ parts of carbon monoxide in 10,000, whereas another street level cab-stand, at the entrance to the waiting room and under the roadway, showed 3 parts in 10,000 a difference in air purity which could easily make for safe or unsafe conditions in the tunnel.

Pipe Conduit Design with Unique Features

In the seventeen eleemosynary institutions in the State of Texas, states J. P. Greenwood, consulting engineer for the State Board of Control of Texas, there is quite a variety of underground constructions of heating mains. At one of the large insane asylums Mr. Greenwood was called upon to design an entirely new system of heating mains for the several buildings. After inspecting several kinds now in service, most of which were found leaking and, in wet weather, water-logged, the State Board of Control called in Professor F. E. Giesecke, of the State University, to help decide the question. As a result, it was decided to use concrete conduits of the type here shown, with removable tops.

Fig. 1 is a cross-section of the concrete box used, while Fig. 2 is a cross-section of the length of the box. The pitch used was 1 in. to 30 ft.

The tops were cast in separate molds and set in place after all the pipe work was finished. Each section of the top is 4 ft. long, and was cast with a section of the reinforcing projecting above for hook eyes in which to handle same in placing on the box. These tops weighed about 550 lbs. each. It was necessary, therefore, to set them with crabs or chain hoist. Each end was left in such a way that when the tops were placed, there was a V-shaped recess which had to be filled with asphalt to make them water-tight. Just before lowering the tops a pour of asphalt was made on the edge of the trough so that when the top was set it would remain tight.

The length of each longest section is 200 ft. that is between manholes. This section had to be poured in one continuous run, so as to avoid joints. The joints at the side of each manhole were made with asphalt.

Through this size box, he states, we ran one 6-in. pipe, two 2-in. pipes, one 1½-in. pipe and one ¾-in. return line. These were all covered with 85% magnesia covering. This in turn, was covered with 8 oz. duck, sewed

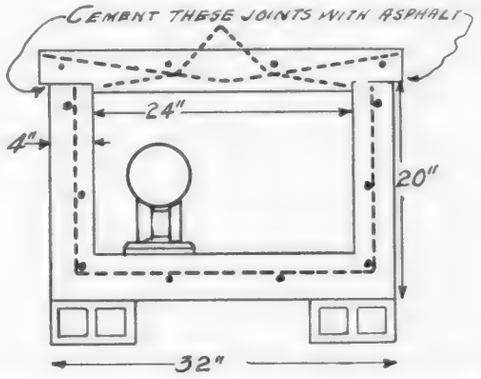


Fig. 1. Vertical Cross Section of Concrete Box Pipe Conduit

"Aggregates: Fine, shall consist of clean, sharp, course sand, and all shall pass through a No. 4 sieve. Not more than 30% by weight shall pass a sieve having 50 meshes per lineal inch. Not more than 3% shall be removed by decantation.

"Course: Shall consist of crushed rock or stone which shall pass over ¼-in. mesh and through a 1-in. mesh.

"The fine and course aggregates shall mix in proportion of 1 to 2 by loose volume and the cement shall be added to produce 1 cu. yard of concrete by the addition of seven sacks of cement.

"Water shall be added to form a working mortar only.

"After the tops have been set in place on the box, dam up each end of a section and fill at least 6 in. of water above tops. Let this remain for at least two hours. Note if all tops have been properly placed tight by observing the end at the lowest manhole. If there is any leakage whatever it will run down the inside of the box and show up in the manhole.

"Place hollow tile under each side of the box its full length. Let this tile butt end for end but do not cement it. At the lower end provide a sewer tile to drain the water away from the manhole."

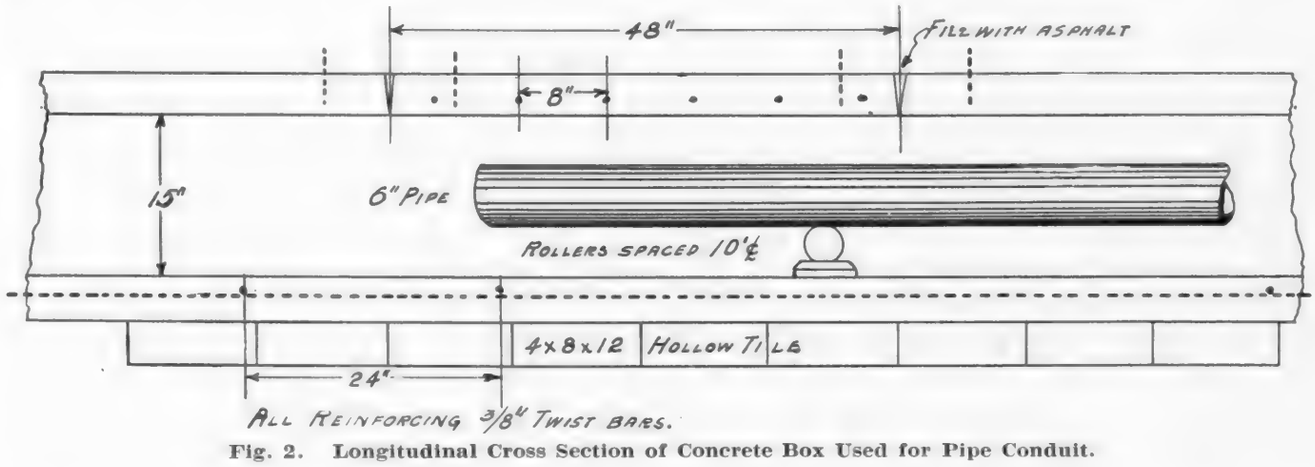


Fig. 2. Longitudinal Cross Section of Concrete Box Used for Pipe Conduit.

well, and afterwards painted with two coats of water-proof paint. The large pipes rest on C. I. rollers and plates, which set on the floor of the box.

Figs. 1 and 2 show the spacing of the reinforcing used, which was all ⅜-in. twist bars.

SPECIFICATIONS FOR CONCRETE

The following specifications cover the concrete.

"Cement to be Portland which shall meet the requirements of the specifications of the A.S. for T.M.

The foregoing specifications, it is expected, will furnish a perfectly water-tight concrete conduit, which will provide the very best thing next to a regular concrete tunnel.

The conduits will run about 10.5 yards of concrete per 100 ft. in length, and there are about 1050 lbs. of steel bars. The forms may be used over and over several times.

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CONSIDERING the time spent by manufacturers in conducting tests of their own products with the object of publishing the results for the benefit of the engineering world, it is a fair question to ask whether the returns are commensurate with the effort and money expended. We have yet to find an engineer or contractor, to whom such test data are submitted, who is not immediately thrown on his guard by the thought that they may easily reflect, in some measure at least, the bias, even though unconscious, of the interested parties. Even in the case of investigations by parties only indirectly interested, the results are often open to criticism not on account of bias necessarily, but through failure to take into consideration all the factors which only those close to the industry are in a position to know. This, by the way, is one of the strongest arguments which is advanced for the conduct of tests of particular devices by such a body as the Research Laboratory of the American Society of Heating and Ventilating Engineers.

One of the outstanding investigations of the latter sort is that recently conducted by the National Association of Building Owners and Managers on radiator traps. These tests were reported in THE HEATING AND VENTILATING MAGAZINE for August, 1923. They were undoubtedly a sincere effort on the part of the building owners and managers to really determine for themselves what to expect in the performance of various radiator traps. Every care was taken to adopt a technique which would leave no room for criticism. To this end the standard testing method used by the U. S. Bureau of Standards was followed. But in the tests themselves some singular variations crept in which, in the judgment of many whose traps were affected, vitally altered the results. The practice followed, for instance, of starting some of the tests before the radiator had cleared itself of air is pointed out by more than one manufacturer as a condition which could easily affect the data secured as far as the temperature ratio is concerned. Perhaps the most important item, however, which has been brought into question, is that of basing the efficiency of the various traps, in part, at least, upon their ability to prevent the passing of steam to the returns. Still another point is that with some types of traps better operating results are secured if a small amount of water is allowed to accumulate in the bottom of the radiators than if the radiators are entirely freed of condensation at all times. A discussion of these and other points connected with the tests is published on another page of this issue where several of the trap manufacturers discuss the subject in the form of a symposium.

There is general agreement among the manufacturers on one point which, we think, will be endorsed by the profession at large. It is that no three-hour test, under laboratory conditions, with brand new devices on clean steam, especially in room temperatures which at times run up to 99° F., are indicative of the actual operation of a radiator trap in a heating system over five or ten-year periods. In other words, there is a vital difference in the operation of almost any device when new and after it has seen service.

One suggestion made which appears highly reasonable is that the testing committee should select buildings at random in which the traps to be tested are installed and make its tests on these particular units, without consultation with the manufacturer, first providing for replacement with traps obtained in the open market. This, we understand, is, in a general way, what the building owners and managers propose to do in a supplementary investigation and it may be that we will yet obtain from that source the information which so many in the heating trade and elsewhere are seeking.

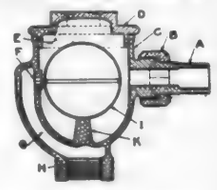
NO SOONER have we permitted ourselves to become thoroughly aroused over the prospect of Fuel-Oil supplanting King Coal, than the gas advocates come along, with banners flying, to tell a waiting world that even the days of Fuel-Oil are numbered and that we might as well prepare at once to succumb to the inevitable, that is, Gas. On another page will be found a discussion of this latest phase of the subject of gas heating, from the view-point of the gas men. Singularly enough, at practically the same moment comes the announcement of the development, under important auspices, of a new type of gas-fired house-heating boiler which is declared to be capable of utilizing no less than 86% of the gross heat value of the gas.

The beautiful thing about the situation, whether one may be a coal, fuel-oil or gas advocate, is that the heating industry is free to adopt any of these forms of fuel without greatly changing its present practice, because there is general agreement that, in any event, the arrangement of the heating systems themselves will continue to utilize steam, vapor or hot water as the heating medium, and piping and radiation as the means for conveying the heat.

Operating Characteristics of Radiator Traps

What the Heating Industry Should Expect of These Devices in the Way of Performance—A Symposium Based Upon the Recent Tests Conducted by the National Association of Building Owners and Managers

N.A.B.O.M. Test Results of Johns-Manville Trap, Float Type



Johns-Manville Float Type.

Date of test	First test Aug. 1, '22	Second test July 31, '22	Third test Aug 1, '22
Barometer reading, in.	29.45	29.45	29.45
Temperatures, deg. F.:			
Room (av).	84.8	85.0	99.4
Radiator (av.)	217.7	190.7	211.5
Steam inlet (av.)	220.7	220.7	212.8
Temperature ratio:	**97.3**	**77.8**	**98.8**
Weights of water, lbs.			
Total condensation	51.99	38.65	43.53
Condensation per hour	17.33	12.88	14.51
Total steam passed	1.90	0	4.66
Steam passed per hour	0.63	0	1.55
Condensation ratio:	**96.5**	**100**	**90.3**

By Johns-Manville, Inc.

Question 1. Do you have means for testing your products under operating conditions?

Answer. We have accurate laboratory apparatus for testing our product. However, it is our opinion that actual operating conditions cannot be exactly duplicated in the testing laboratory.

Question 2. Have you tested your traps along the lines followed by the National Association of Building Owners and managers and, if so, wherein do the results differ?

Answer. Yes. We have found the average efficiency to be higher than the average of the three tests quoted.

Question 3. Do you consider that the three tests referred to are sufficient to give accurate comparative data? (We are referring here to laboratory tests only.)

Answer. No. They only give certain comparative data on the operation of new traps.

Among other things, the tests should include operation at lower pressure differentials, conforming more nearly to modern economical practice, and a greater number of traps of the same make should be tested. These should, in all cases, be traps that have been in actual service. The testing apparatus should be checked for the accuracy of its steam leakage indications. Atomized condensate might be carried over to the condenser and measured as steam.

Question 4. Do you consider the performance of your trap as reported in these tests, indicative of its action under service conditions? If not, please state why.

Answer. No. The pressure differentials should more nearly conform to those used in actual practice.

Since the tests cover only a few hours' operation of new and carefully-adjusted traps we believe that they cannot be held to indicate the probable efficiency of those traps over an extended period of service.

Question 5. What do you consider should be the results to be desired in a test of your trap. (Such as passing steam, etc.)

Answer. For the greatest number of years—noiseless operation, high operating efficiency, and a minimum of renewals, repairs and adjustments.

Question 6. Have you any general criticism of the tests as reported?

Answer. Since it is quite possible for a steam trap, or any other piece of mechanical equipment, to drop from 100% efficiency to 50%, or less, after a year or two of service, it is our opinion that short tests of new traps are of little value to the building owner, his engineer or the trap manufacturer.

Careful tests of radiator traps which have been in service for a number of years would form a gauge by which their relative efficiency and durability could no doubt be measured with considerable accuracy.

Perhaps no tests of heating apparatus in recent years has aroused so much interest and comment as those conducted by the National Association of Building Owners and Managers on some nineteen representative makes of radiator traps. The results of these tests were published in "The Heating and Ventilating Magazine" for August, 1923. Certain conditions applying to some of the tests, such as the short intervals between the ending of one series of experiments and the beginning of another, also the fact that certain of the data appeared to be contradictory, has made it seem advisable to open for discussion the general subject of what we should look for in the operation of a radiator trap and how test data should be interpreted.

For this reason an invitation was extended to all of the manufacturers, represented in the tests in question, to express their views on the subject. In order to furnish a general basis for discussion, they were asked to consider the following propositions and the accompanying presentation is a symposium of their replies.

THE QUESTIONS

1. Do you have means for testing your products under operating conditions?

2. Have you tested your traps along the lines followed by the National Association of Building Owners and Managers and, if so, wherein do the results differ?

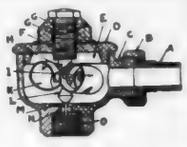
3. Do you consider that the three tests referred to are sufficient to give accurate comparative data? (We are referring here to laboratory tests only.)

4. Do you consider the performance of your trap, as reported in these tests, indicative of its action under service conditions? If not, please state why.

5. What do you consider should be the results to be desired in a test of your trap? (Such as passing steam etc.)

6. Have you any general criticism of the tests as reported?

N.A.B.O.M. Test Results of Trane Trap, Solid Thermostatic Type



Trane, Solid Thermostatic Type.

Date of test	First test Aug 21, '22	Second test Aug 12, '22	Third test Aug 11, '22
Barometer reading, in.	29.4	29.53	29.56
Temperatures, deg. F..			
Room (av)	87.1	87.1	86.5
Radiator (av.)	217.1	216.9	210.9
Steam inlet, (av.)	220.6	220.8	213.1
Temperature ratio:	**97.3**	**97.0**	**98.2**
Weights of water, lbs..			
Total condensation	46.46	49.78	43.27
Condensation per hour	15.49	16.59	14.42
Total steam passed	0.98	0	0.18
Steam passed per hour	0.33	0	0.06
Condensation ratio:	**97.9**	**100**	**99.5**

By the Trane Company

1. Radiator traps are so essential to the success of a heating system, especially those operated in connection with a vacuum pump, that we believe that no manufacturer can afford to sell radiator traps without having a laboratory for testing his own product; in fact, it would be just as foolish to send out radiator traps without a sufficient labor-

atory-testing equipment as it would be to send out an ordinary scale balance for a butcher shop without the proper setting of the zero point. For this reason The Trane Company have always had complete laboratory equipment for testing its various products and in all cases an attempt is made to make these tests exactly the same as are obtained in actual service.

2 and 3. We use testing apparatus exactly the same in principle as that outlined in the tests made by the National Association of Building Owners and managers, but we do not believe the value of the comparative tests made by the above are necessarily conclusive as to the comparative merit of traps that are supplied generally by the various manufacturers. The tests were made on too few traps of any one manufacture and undoubtedly they were made of new traps instead of traps which had been in service for a period of more than one year. With very few exceptions, if a buyer were to buy traps on the report made of the National Association of Building Owners he could select almost any of the traps and, if they performed in service exactly the same as they did in the test. the buyer would be assured of a satisfactory and efficient heating system and he could select the cheapest trap. Unfortunately, there are other considerations with which the owner must be acquainted. Primarily he must know whether or not the trap will stand up and give as perfect performance for five or ten years after he has made the purchase. For this reason the buyer must investigate the construction of the various traps very carefully and particularly investigate the service in which traps of various makes have been given in other installations similar to his own.

4. The performance of the Trane trap in these tests was very satisfactory, and. while percentages were not in all cases as high as we obtain in our own laboratory, from an operation standpoint, it could be considered a perfect performance.

5. Because tests made by other institutions and other engineers are very similar to those made by the National Association of Building Owners, trap manufacturers of necessity arrange to make their traps so that they will show high efficiencies, both according to temperature ratio and condensation ratio, as it is understood in the report made by the National Association of Building Owners. But we do not believe that having either the condensation ratio or the temperature ratio close to 100% is essential. A radiator trap should never leak steam. It would be better to have the trap steam tight and have the temperature ratio even less than 95% than to have it 100% with the hazard of leaking steam whenever a particle of dirt enters the trap. The condensation ratio can be neglected entirely because, with a temperature ratio above 95%, the condensation ratio must be equally high. You will notice in most all tests this is true. Where the reverse is true we believe that the tests and reports are inaccurate. The average temperature of only eight thermometers does not necessarily represent the actual average temperature of the radiators, although it approaches it closely. I believe that a trap with a 100% temperature ratio is not as good as a trap with a temperature ratio of 97% because the trap would be altogether too delicate. If it actually prevented steam from passing it would seem more or less like a scale balance and would have to operate at a temperature variation of less than 1 degree. 'It would be easily put out of adjustment or injured. It would be easily interferred with by dirt and scale and would have no power to operate.

We believe the tests should be made at the National Association of Building Owners, and particularly those made by the Bureau of Standards, should be modified, making the requirement of the amount of steam lost very close to zero and to take no account of the condensation ratio but to require a temperature ratio about 95% and less than 98%. The difference between 98% and 100% would be the factor of safety, instead of an expression of high efficiency. The factor of safety is simply a setting of a trap at a temperature less than 212°. since 212° represents both the point of failure and perfection. It is a factor that produces power to combat with dirt and scale. Why should we not allow an instrument in a dirty box a margin of force to combat dirt—when such margin does not waste an ounce of coal nor effect the maximum capacity more than a few percent?

I believe the tests should be made at about 5 and 10 lbs. boiler pressure, in addition to what is now made and that the requirements under these conditions should be a fixed maximum and minimum temperature ratio in the radiator. A temperature ratio less than 100% gives a temperature drop through the trap and therefore is highly desirable.

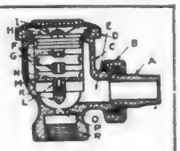
A temperature drop through the radiator trap is highly desirable, not only to prevent the wastage of steam in the return line but also to allow the return water to run back to the vacuum pump or other pumping equipment at a temperature of less than 180°. By having this temperature drop through the trap you are always assured of a perfect operation of the pump and you are further assured that the vacuum pump will not operate more than a small fraction of the time.

Radiator traps are essential to heating systems wherever there is a vacuum pump. Engineers calculate vacuum pump sizes by what they have found by experience to be required. An ordinary figure for air leakage in the return lines used in calculating vacuum pump sizes is ¼ of a cubic foot per 1000 sq. ft. radiation per minute. If we had perfect traps and these traps had a temperature drop of at least 20°, there would be no wastage of steam. There is very little leakage of air on a tight piping system and there would be no cause for the vacuum pump to require a capacity of anywhere near ¼ of a cubic foot per 1000 sq. ft. of radiation.

If this temperature drop test is adopted by the trap manufacturers it will mean a large margin of safety for the operation of traps and it would mean that vacuum pumps can be made smaller and that traps will operate more satisfactorily for longer periods than they have in the past.

N.A.B.O.M. Test Results of Hoffman No. 8 Trap, Liquid Thermostatic Type

Hoffman No. 8, Liquid Thermostatic Type.



	First test	Second test	Third test
Date of test	Aug. 24, '22	Aug. 23, '22	Aug. 23, '22
Barometer reading, in.	29 32	29 32	29 32
Temperatures, deg. F.:			
Room (av.)	87.5	90.8	87.0
Radiator (av.)	218.7	218.5	211.4
Steam inlet, (av.)	220.5	220.5	212.7
Temperature ratio:	**98.6**	**[illegible]**	**[illegible]**
Weights of water, lbs.:			
Total condensation	42.94	44.91	44.57
Condensation per hour	15.15	15.85	15.73
Total steam passed	0.63	0.10	0.65
Steam passed per hour	0.22	0.03	0.23
Condensation ratio:	**98.5**	**99.8**	**98.5**

By the Hoffman Specialty Company

1. We have a well-equipped experimental department where our products undergo development, laboratory and operative tests.

2. We have data on tests identical with those in question, except that the radiator contained 100 sq. ft. of heating surface, instead of 80 sq. ft., in which the following results are a fair, average performance of stock traps selected at random:

	Test No. 1	Test No. 2	Test No. 3
Supply pressure, in..	6	6	1
Return pressure, in..	..	0	..
Vacuum, in.....	10	..	5
Temperature ratio...	99.2	99.0	99.2
Steam passed, after calculating re-evaporation, pounds per hour.	0.43	0.07	0.08
Variation in waterline in gauges.....	None	None	None

3. Yes, if the tests are properly conducted and observations carefully and accurately made. In connection with the performance of our traps, we are willing to have them tested under pressures considerably higher than those covered by these standard tests, the limit of our trap being 50 lbs., under which it will show practically the same efficiency as under low pressure.

4. No, we do not consider the performance of our trap in these tests indicative of its action under service conditions. This is based on the results obtained from many tests in our laboratory, and further reasons of a general nature will be given in reply to question (6).

5. The perfect trap, in our judgment, is one which relieves all air (including that released by condensation of steam) and water from the radiator without steam loss. In all our reported tests, the Hoffman trap shows a thermal efficiency of 99% or over, the average being about 99.2%.

6. We do not understand the object in showing a condensation ratio, for traps which hold up water in the radiator show a condensation ratio of 100% which is misleading in that it indicates perfect action. There is a mis-statement in paragraph 131, page 23 of the report that "the total amount of water collected in the condensation pots and steam-passed pots is evidently equal to the amount of steam received by the radiator." This makes no allowance for steam condensed in the radiator and held there because of faulty trap action. We also note that the tests were started with varying amounts showing in the water gauges. In some tests there was ⅛ in. showing in the gauge, while in others it was as high as ⅞ in. and above. The presence of this body of water in the radiator would have an important bearing on the operation and efficiency of the trap. In order to obtain accurate results, the water in the radiator should be drained before starting each test, so that the traps would all be operating under the same conditions.

The tabulated results of the temperature readings show that the tests were not conducted with the same degree of regularity and the question which arises is "How long a preliminary run was allowed before observations started?" It appears as though an attempt was made to let the radiator run until it was apparently steam hot all over, at least the intention shows that, but the results differ. For example, between tests (3) and (2) of the Hoffman trap, there was a 20-min. interval between the change in conditions. In going from one test to the other, the vacuum in the return was dropped from 5 in. to atmosphere, and observations began on test (2) before the radiator had been given an opportunity to clear itself of air, as was done in the tests of other traps. Reference to readings of thermometer 22 and 23 will indicate this. This, of course, would reduce the temperature ratio considerably. It is suggested that the results of the tests of Hoffman trap be compared with those of Trap No. 3 in which the tests were made on three different days, and in each case the radiator was permitted to reach an over-all steam temperature before observations started.

We might mention a few of the many instances where there was a variation in starting conditions. Trap No. 2A shows a time interval of 20 min. between tests (1) and (2). In the latter test, the air, which went into the radiator when the vacuum was broken, was not given an opportunity to be relieved before the observation started. If test No. 2 had started at 2:20 there would have been a slightly higher temperature ratio, for the trap would then have cleared the radiator of air as indicated by thermometer No. 23. The same condition shows in trap No. 6 with a 10-min. interval between tests (1) and (2), and a very low temperature indicated by thermometers Nos. 22 and 23. In the test of Trap 10B there was a 10-min. interval between tests (2) and (1). The temperature at thermometer No. 23 in test No. 1 was only 3° higher than the temperature at the same point when test No. 2 was stopped and 32.5° below the inlet temperature. Other similar cases can be cited but it is not considered necessary to go into all of the details wherein similar conditions show.

It will be noted that in almost every instance, tests which started in the early morning showed traps which had a low temperature ratio. Test No. 3 of Trap 2-A starting at 7:55 A. M. very clearly shows that there was considerable air in the radiator at the time test started. Likewise, in Trap No. 6, Test No. 3 indicated the presence of air in the radiator at start of observation, for the temperature at thermometer No. 23 is 27° below the inlet temperature. The same is true in connection with Trap 15-A where in Test No. 1 thermometer No. 22 shows a temperature 10.5° less than the inlet temperature. In test No. 3 of the same trap, thermometer No. 22 is 4½° below the inlet temperature. These are a few of the many instances which could be cited which apparently indicate haste on the part of the observer in starting the test.

In addition to starting with the same water level in each test, the proper procedure would have been to cool the radiator to room temperature after each test, and open up to atmospheric conditions; then turn on steam for a certain time and start observations, the same time being allotted each trap, or to permit the radiator to run until it was entirely filled with steam and then start observations. We believe the first suggestion would be preferable. It is evident that the method used in testing was apparently an indiscriminate variation of the tests on different days, in different sequence, and under different conditions. Consequently, the radiator temperatures, amounts of condensation, etc. were different at the time of admission of steam and start of observations. These inequalities would have a serious effect on the trap efficiencies in a three-hour test.

It is noted that the tables show "steam leakage" of each trap with no correction for re-evaporation, which would be comparatively heavy under vacuum conditions. By a simple calculation, the re-evaporation could be determined and actual amount of steam passed indicated.

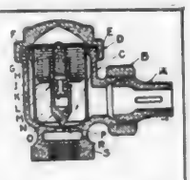
There is also considerable variation in the condensation of the radiators as evidenced by the following table of Test No. 1, using the traps having the highest and lowest temperature ratios and the Hoffman trap:

Trap No.	Temp. Ratio	Room Temp.	Condensation Lbs./Hr.	Water Level	Steam Passed Lbs./Hr.
3	99.5	83.5	14.31	Steady	1.98
14	94.2	85.9	16.58	Variable	.30
5	98.6	87.5	15.15	Increased	.22

It will be noted from the above table that the trap reported as the least efficient, as far as temperature ratio is concerned, passed the most condensation, in spite of the higher room temperature, and also Trap No. 5, with a still higher room temperature discharged more condensation than Trap No. 3 and also showed an accumulation of condensation in the radiator. The above is submitted as a sample of one of the many combinations which can be made, indicating results which are rather difficult to explain, based on the data submitted in the report.

There is another point which is worthy of note, i. e., the stethescope method of determining steam loss. While it may be true, that steam leakage through the discharge port can be determined by means of the stethescope, it might be pertinent to inquire whether or not there is any difference in sound if air is released through a partially open valve. In the writer's experience, the "hiss" of air released from a trap has the same sound as that of steam, and the only way of differentiating between air and steam would be to submerge the outlet of the trap under water, escape of air being indicated by its bubbling up to the surface, while steam will be immediately condensed, showing no bubbles if test is under low pressure and the water sufficiently cool to condense all escaping steam. While this stethescope test has no particular bearing on the general results of the test, it indicates possibly an unfamiliarity with actual operating conditions which might be considered in connection with the test methods.

N.A.B.O.M. Test Results of Type E Sarco Trap (New Model), Liquid Thermostatic Type



Type E Sarco (New Model), Liquid Thermostatic Type

	First test	Second test	Third test
Date of test	Nov. 7, '22	Nov. 8, '22	Nov. 9, '22
Barometer, in.	29.33	29.50	29.67
Temperatures, deg. F.:			
Room (av.)	81.7	85.4	85.5
Radiator (av.)	219.6	220.0	213.0
Steam inlet (av.)	220.5	220.8	213.3
Temperature ratio:	**99.3**	**99.3**	**99.7**
Weights of water, lbs.			
Total condensation	50.53	49.82	43.91
Condensation per hour	16.84	16.61	14.64
Total steam passed	1.5	0	0
Steam passed per hour	0.5	0	0
Condensation ratio:	**97.1**	**100**	**100**

By the Sarco Company

Radiator traps should be designed and constructed so that the trap will close against steam at all times under practical working conditions within a range of 0-20lbs. steam pressure. The trap also must not pass condensate at a temperature too high to permit a vacuum of at least 10 in. at the pump in vacuum systems.

Valve movement should be sufficient and sensitive enough to pass all condensate and air as fast as it collects. The construction should be such that the ordinary foreign matter found in heating systems will not affect its operation, even after a number of years' service. The closing pressure should be great enough to assure tight contact with the seat and the seat so designed that it will not collect dirt or scale.

The valve opening diameter and lift of valve is important on vapor systems

and must be great enough to pass the condensate and air even when the working differential is slight.

The manufacturer must take the foregoing conditions into consideration in the design of the trap and offer one valve which will meet all the aforesaid conditions.

All traps sent out by the manufacturer should be tested under operating conditions as far as possible; that is, under steam at the pressures and vacuum which the trap is to function.

In particular reference to your questions, we have this to say:

1. We have equipment at our factory which duplicates operating conditions as far as it is possible. We test each trap under various steam pressures for which it is designed and over a sufficiently long period to determine whether the assembly has been correctly made. This test brings out any defects in material and also whether the amount and quality of the filling used is up to standard. This testing equipment represents a considerable outlay but we find that the quality of the product is brought up to such a high standard that this cost is compensated for by less trouble in the field.

2. In designing the Sarco trap, in order to bring it up to a standard which was considered satisfactory and, as far as we knew, the only real standard at that time, we duplicated the testing equipment in use at the Bureau of Standards, Washington, D. C. We adopted the Bureau of Standards' specifications and each Sarco trap manufactured must pass this test before it is put on the market.

The test made by the National Association of Building Owners and Managers of Chicago is practically a duplication of the Bureau of Standards test and therefore it may be considered that Sarco traps were tested along the same lines as this recent test. We obtained practically the same results as the Building Owners' and Managers' test.

3. We consider that the three tests made by the National Association of Building Owners and Managers gave fairly accurate data for comparative purposes. To obtain more complete figures the period of the test should be increased and in that respect only we feel that a test so short as three hours does not give an absolutely true picture of what a trap will do if submitted to tests covering a considerable period of time.

4. The Sarco radiator trap, type "E" performs practically under service conditions along the lines as reported in these tests, even where the trap has been installed for a considerable length of time.

5. The result which we expect of the Sarco radiator trap in a test is to maintain a temperature efficiency in the radiator of not less than 99% and, in the amount of vapor passed, an efficiency of not less than 97%, including re-evaporation in return.

6. We have no general criticism of the tests as reported. We believe they were well conducted and that the results are exceptionally true. They check up very closely with tests which we have made ourselves.

Legal Decisions

Evidence that Pipes Sagged Five Years after Installation of Heating Plant Immaterial

In an action for the purchase price of a heating plant installed in the defendant's house, the defendant set up in defense breach of a warranty that the plant would heat the rooms to 70° F. during coldest winter weather. The trial court excluded evidence that the pipes sagged at a time five years after the plant was installed. The defendant, however, offered no evidence that the pipes sagged immediately after the plant was installed. Evidence was introduced by the defendant tending to show that the plant wholly failed to meet the requirements of a first-class heating system, but he made no claim in his pleadings that the failure to accomplish this result was due to improper or defective installation. Proof that the pipes sagged five years after the plant was installed was held by the Iowa Supreme Court, Iowa Windmill & Pump Co. v. Tobin, 195 N. W. 989, not to be material, unless their condition was the same at the time the witness saw them as it was immediately after the system was installed, in the absence of some claim that the original installation was defective. The defendant did not attempt to prove that the pipes sagged at the time the plant was placed in the building.

Effect of Clause "Free From Mechanics' Liens" in Installation Contract

A contract for the installation of a heating plant in an apartment, was executed in duplicate on printed forms, both copies of the contract having, interlined, in ink, the words "free from mechanics' liens." It appeared that the words were written in at the time of execution of the contract, as an authentic part thereof. The Illinois Appellate Court holds, Herman H. Hettler Lumber Co. v. Hodge, 227 Ill. App. 383, that by the words of the contract the contractor expressly excluded himself from all rights to a mechanics' lien under the Illinois act, and that the words interlined were not limited to liens of subcontractors.

Ascertainment of Liability Under Contractor's Bond

A contractor entered into a contract with the school board of Philadelphia to install a ventilating system in a school building of the district, and for the faithful execution of the contract gave a surety bond in the sum of $1,005. There was also an agreement by the contractor with the surety company to indemnify the latter for all loss and expense incurred under the bond. The surety company, on demand of the school district, paid the latter a sum which it was asserted the district, on the original contractors default, had been obliged to pay, another contractor for the completion of the work in excess of the amount which the original contractor had agreed to accept. Payment was made by the surety company against the contractor's objection, and after notice that the latter would defend any action brought against the surety company. The surety company then sued the contractor for the amount it had paid the school district.

The only evidence of the contractor's default produced was a certificate by the secretary of the Board of Public Education that the board had agreed to pay the contractor who had completed the work a certain sum therefor. The contractor's bond to the school district, however, contained an agreement by the contractor and the surety that the fact of default and the amount of liability on the surety contract should be determined by the Board of Public Education for whose protection the contract was made, and evidenced by the oath or affirmation of the president or other member of the board. The Pennsylvania Superior Court, *Fidelity & Deposit Co.* v. *Call,* 81 Pa. Superior Ct. 132, held that the secretary's certificate alone was not sufficient to entitle the surety company to a directed verdict. It was competent for the parties to agree upon a method of ascertaining the liability under the bond and to provide therein for the kind and quality of evidence necessary to make out a claim. Having done so the contract became the law of the case and the method of procedure. The certificate of the secretary of the board of education was a very different thing from the statement on oath of a member of the board. Judgment for plaintiff was therefore reversed for a new trial.

Valid Consideration for Lessor's Promise to Pay for Repairs on Heating Plant

The lessor of a business building covenanted to install heating facilities adequate to maintain 75° F. at all times. The radiation on one of the floors proving inadequate, the lessor subsequently told the lessee to have the necessary repairs made on the heating plant and he would pay for them. In an action by the lessee for the cost of the repairs, the Michigan Supreme Court holds, American Cigar Co. v. Shewitz, 195 N. W. 55, that there was a valid consideration for the lessor's promise to pay for the repairs, since by the lessee's acting on this promise, the lessor was relieved of liability to an action for violation of the covenant in his lease, and the lessee incurred liability and expense which he was under no obligation to incur, in reliance on the promise. Judgment for plaintiff was therefore affirmed.

The Testing of Cartridge Copper Heaters

SINCE the trend of the times is leading towards the adoption of unit copper heaters for indirect radiation, the heating and ventilating industry at large is quite rightly curious as to what steps are being taken by the manufacturer to test out his product so that the customer can feel sure that, once installed, he need give it no further attention, but can be reasonably certain that his unit will give the desired service for a long time to come.

The manufacturers of Cartridge copper heaters have long realized that the first inquiry of the trade would have reference to their span of life, and again, since this type of heater has been in existence but three years, it was felt that extremely intensive tests would be necessary to simulate the working conditions equal to a long period of time.

SCOPE OF TESTS

As a result, the following tests were devised and installed by the manufacturers:

1. All Cartridge copper heaters, irrespective of their size are tested for one hour under live steam at a pressure of 40 lbs. gauge.
2. The heaters are then retested under water with air at 25 lbs. pressure.
3. The heaters are again connected to a steam line at 18 lbs. pressure where they are left for two hours.
4. Final inspection is given under water with air at 25 lbs.

The object of this varied test is to insure that, insofar as humanly possible, no troubles will develop after the unit is installed.

HEATERS ALSO SUBJECTED TO MAKE-AND-BREAK TESTS

In addition to the above tests, the manufacturers are continuously keeping some of its sample heaters under what is termed a "make-and-break" test. As shown in Fig. 1, unit heaters are mounted to a steam line at 40 lbs. gauge pressure. Every heater is subjected to a continuous air blast at a velocity through the tubes of 2000 ft. per minute.

At 1-min. intervals, the steam is alternately shut off and admitted by means of a diaphragm valve. The shutting off of the steam with the air blast always on, creates a vacuum of approximately 26 in. of mercury so that the net effect of each cycle of operations is 40 lbs. steam pressure—26 in. vacuum. Besides, the stresses imposed upon each unit by the alternate compressive and tensile forces occasioned by the vacuum and steam pressures, respectively, the heaters are also subjected to the very quick changes of the temperature of the live steam (286° F.) to that of the room (65° F.) once every minute. The average number of cycles to which each sample heater is subjected is 6000 but quite frequently some are left on the line up to 15,000 reversals,—without any sign of a defect.

This "make-and-break" test is for the purpose of simulating length of service. Based on 200 heating days a year, with steam turned off and on at an average rate of four times a day, 6000 vibrations are equivalent to 7½ years and 15,000 vibrations equivalent to 18¾ years of service. It has not been thought necessary to extend the test beyond this period.

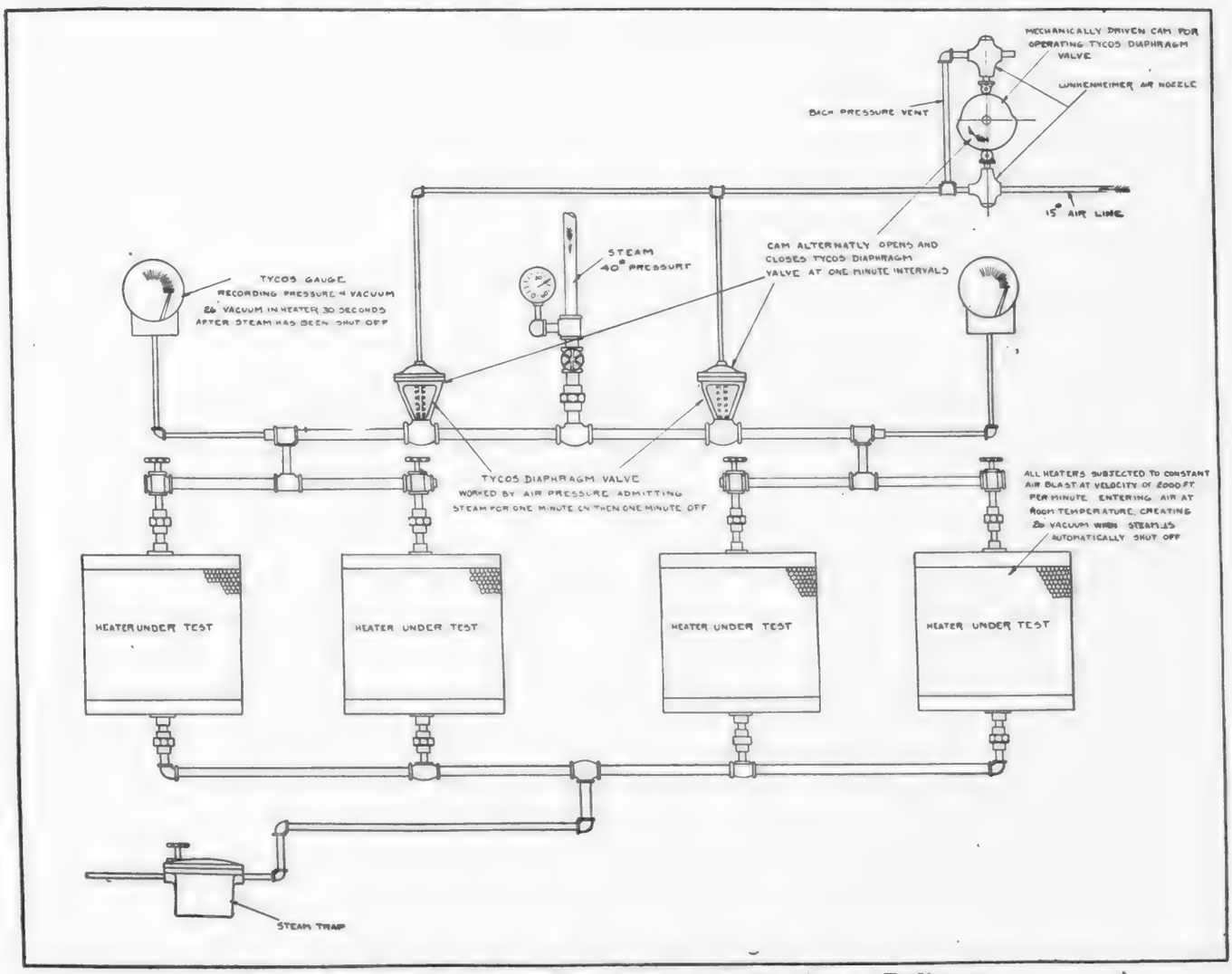

MECHANICALLY DRIVEN CAM FOR OPERATING TYCOS DIAPHRAGM VALVE
WUNNENHEIMER AIR NOZZLE
BACK PRESSURE VENT
15# AIR LINE
STEAM 40# PRESSURE
CAM ALTERNATELY OPENS AND CLOSES TYCOS DIAPHRAGM VALVE AT ONE MINUTE INTERVALS
TYCOS GAUGE RECORDING PRESSURE & VACUUM 26" VACUUM IN HEATER 30 SECONDS AFTER STEAM HAS BEEN SHUT OFF
TYCOS DIAPHRAGM VALVE WORKED BY AIR PRESSURE ADMITTING STEAM FOR ONE MINUTE & THEN ONE MINUTE OFF
ALL HEATERS SUBJECTED TO CONSTANT AIR BLAST AT VELOCITY OF 2000 FT. PER MINUTE. ENTERING AIR AT ROOM TEMPERATURE, CREATING 26" VACUUM WHEN STEAM IS AUTOMATICALLY SHUT OFF
HEATER UNDER TEST
HEATER UNDER TEST
HEATER UNDER TEST
HEATER UNDER TEST
STEAM TRAP

Fig. 1. Test Line Layout for Testing Cartridge Copper Radiators

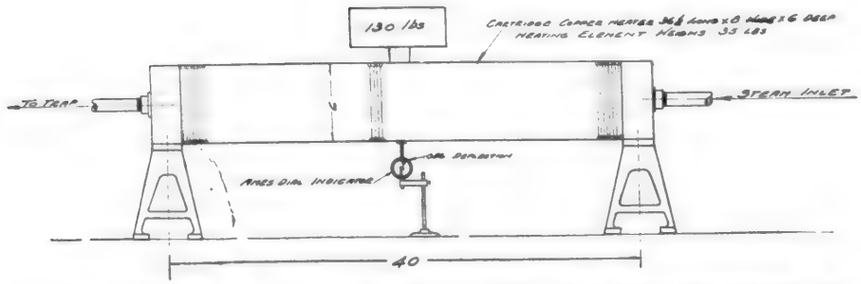


Fig. 2. Testing Apparatus for Determining Transverse Strength of Cartridge Copper Radiators

TEST FOR STURDINESS

Again, it is a common fallacy to assume that because a certain article is light it is frail, but to ascertain the sturdiness of the Cartridge heater, the writer recently submitted a sample unit to the following test as outlined in Fig. 2. A heater was mounted on two supports 40 in. from center to center. The steam pressure within the heater was kept to 10 lbs. throughout the duration of the test and weights in increments of 5 lbs. added at the center until the total exterior unsupported load amounted to 130 lbs. With this load the heater showed a deflection of 0.056 in. at the center after 5 hours and immediately sprang back to no deflection when the load was removed. Needless to say, the heater showed no effects of this strain.

EXAMINATION OF HEATER TUBES AFTER SERVICE

We recently have examined the tubes of heaters which had been in active service for two years and the surfaces of the tubes exposed to the steam were slightly coated with oxide and, moreover, the wall thickness of the tubes measured the same as the day the core was manufactured. Had there been erosion present, the exposed surfaces of the tubes would have presented a bright appearance giving visible evidence of wear.

Within the past two years Cartridge copper heaters have been used in this country from coast to coast; their purposes have been greatly diversified but invariably they have given even better results than were expected. There is no reason why the life of these heaters should not be equal to other types of heaters now employed.

ENGINEERING DATA IN PREPARATION

Attention is called to Fig. 3, showing detailed construction of the wind tunnel just recently installed at the U. S. Cartridge Company Laboratory. This company plans to start work at once to tabulate accurate engineering data on the efficiency and capacities of Cartridge copper heaters.

Radio Broadcast Talk on Heating Problems

An up-to-the-minute method of bringing home to the American public reliable heating information was adopted recently when E. F. Glore, treasurer and general sales manager of the Abram Cox Stove Company, Philadelphia, broadcasted by radio a talk on heating problems. The wonderful possibilities in this innovation for the education of the consuming public, it was realized, apply with equal force to the field of heating and ventilation. Speaking from the broadcasting station of Strawbridge & Clothier, Philadelphia, Station WFI, to an audience which must have numbered thousands of householders, Mr. Glore, discussed the topic, "Getting the Most Out of Your Coal Bin."

The talk was delivered February 27, just as the major portion of the country was emerging from a series of snow storms and icy blasts. While Mr. Glore's talk dealt with the proper methods of charging warm-air furnaces, boilers and ranges and regulating the drafts, he did not overlook the opportunity to suggest several times that the home-owner consult with his heating contractor.

Mr. Glore started his talk by urging his hearers to consider now their heating plans for next year. He then discussed the different items that contribute to the saving of coal by maintaining a proper balance between the boiler, furnace or range, and the chimney. He spoke particularly of having the correct size of smoke pipe and chimney, emphasizing the fact that draft is dependent upon volume, as well as upon height.

Mr. Glore urged his hearers to see that the smoke pipes were removed t the end of the season, and the bottom of the chimney cleaned out, so as to avoid the chance of a restricted area in the smoke pipes and flues.

On the sizes of coal to use, he said "most people use the stove size because they never tried the cheaper sizes, such as pea or buckwheat. And not every flue will properly take care of the smaller sizes, inasmuch as they pack closer in the firebox and do not permit of sufficient air getting through into the firebox to properly burn the coal. The way to try out pea or buckwheat sizes is first to mix them with the stove-size coal, and gradually do away with the stove-size, remembering that when you use pea or buckwheat sizes, you must keep a few inches of ashes on the grates to prevent the small coal from falling through the grates."

Mr. Glore also had some advice to give regarding the operation of the fire, urging, among other things, that when it comes time to recoal the fire, some fresh coal should be put on before, rather than after, shaking the grates, as this allows the fresh coal to fall down among the live coals.

Declaring that most people attend to the fire too often and shake the fire too vigorously, Mr. Glore stated that over $4,000,000 were spent last year by the houseowners of the United States for grate bars. This, he said, amounts to the cost of 560,000 tons of coal, or a train load of coal, consisting of 14,000 cars reaching from Wilmington, Del., to New York, or from Philadelphia to Harrisburg, 105 miles.

Finally, he urged the use of a thermostat or heat regulator, declaring that such a device will save its cost in a short time, besides giving a more uniform temperature with less attention to the fire.

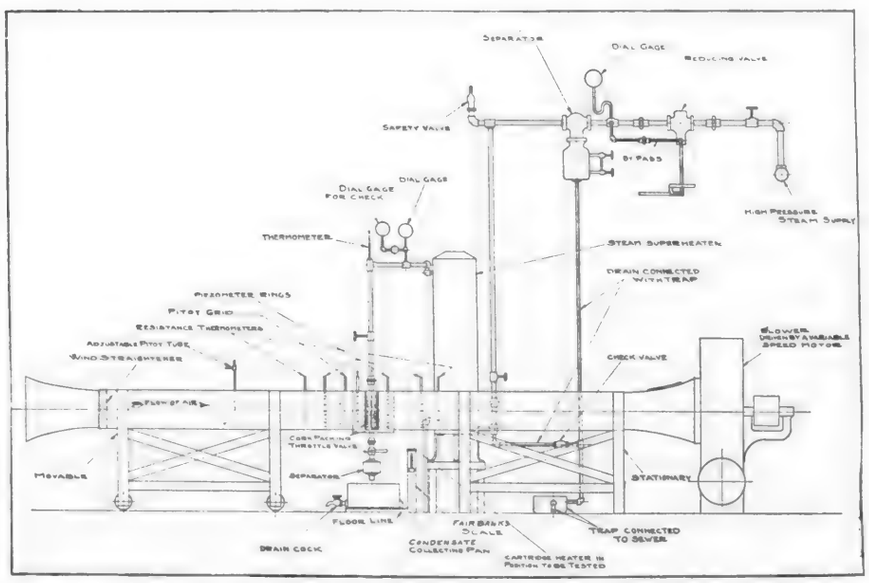


Fig. 3. Diagram of Steam Tunnel Used by U. S. Cartridge Company for Testing its Cartridge Copper Radiators

Correspondence

Points on Heating Boiler Operation

EDITOR HEATING AND VENTILATING MAGAZINE:

What is the amount of water which usually remains in a steam or vapor heating system during normal operation? Take a residence system of 600 sq. ft. of radiation. A one-pipe system would probably contain more water than a two-pipe system because the condensation must return against the steam flow in the radiator branches.

At what steam velocity leaving the boiler is water entrained?

These questions become important when boilers having little water capacity are considered for installation, such as gas-fired heating boilers.

Portland, Oregon, L. KRONER.

Assuming thermostatic return valves working properly, condensation will be returned to the boiler at the same rate as the steam supplied, so that no water should remain in the system. The slight rise of water line in the return, say 27 in., (due to drop in pressure), is of no importance, as the volume in the vertical return pipe (1½ in. pipe for 600 sq. ft.) would be, at the most, about 0.03 cu. ft.

Not counting piping surface, the condensation for 600 sq. ft. of radiation is 150 lbs. per hour. If this were retained for part of the time, say 5 minutes (due to improper working or sluggishness of all thermo valves), then the system would retain 12.5 lbs., an amount equal to 1.5 gal., or 0.2 cu. ft. If the boiler is very small, say an area of 4 sq. ft., 0.2 cu. ft. would lower the water line only 0.6 in. for the total area of 4 sq. ft.

In a properly-designed one-pipe system with large pipes, the water will flow back to the boiler as readily as in the two-pipe system. This refers to normal operation. When steam is turned into a cold radiator, that is another matter. During the heating-up period, water will remain in a radiator with one-pipe connections because the velocity of inflow is then way above normal, but when the heat content of the metal is satisfied, the water will be returned. As shown by tests, the rate of condensation in a cold radiator will reach three and one-half times normal condensation in 10 minutes' time, returning to normal after a further lapse of 15 minutes.

Priming is caused by dirty water, or by an improperly-designed boiler or system. For such conditions, the amount of water retained is often serious and the velocity of steam leaving the boiler must be very low, but this is neither normal nor correct operation. For clean water and proper conditions the correct velocity is determined by the manufacturer for the design of boiler in mind. This velocity varies with the amount of steam space, disengagement surface, and water passages of the boiler, and, probably most important, the steam outlets —their size, number and distance above the water-line of the boiler.

In most cases of priming, trouble can be averted by arranging the piping from the outlets so as to drop in a steam header, the ends of which are dripped into the return header at the boiler. In this way, any water carried over will be prevented from entering the system.

Water Troubles in Two Vacuum Heating Systems

EDITOR HEATING AND VENTILATING MAGAZINE:

I have recently come in contact with two vacuum heating systems that cause the same trouble. Being anxious to get at the bottom of this trouble, I am writing for your help in solving the problem. I might say that I have been working on heating installations for a number of years, but this is my first trouble of the kind described and it seems to baffle all of us.

We have tried varying the vacuum from 2 in. to 10 in. and the steam pressure from 2 to 6 lbs., but the results are practically the same. We don't know whether the cause

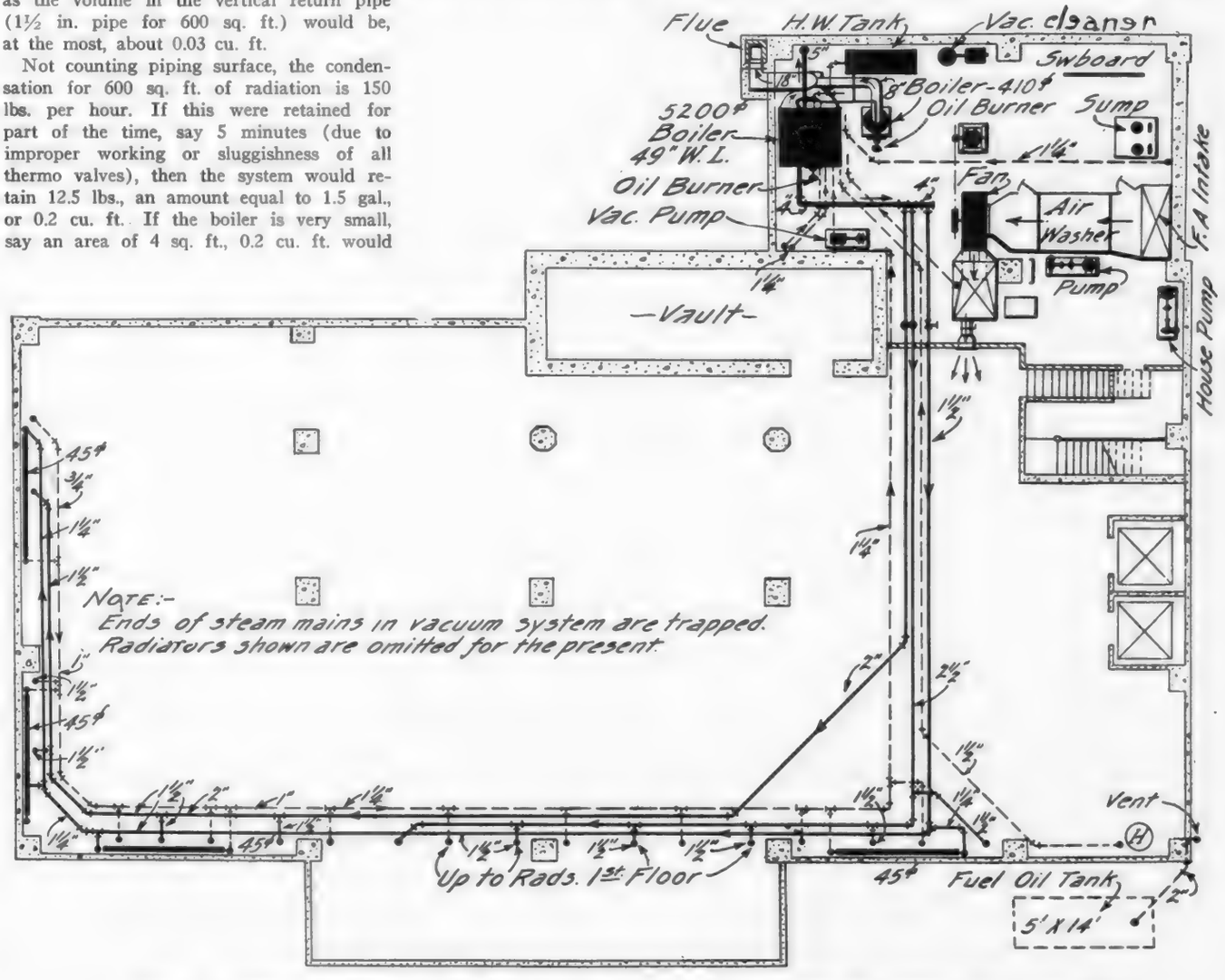


Fig. 1. Combination Vacuum and One-Pipe System Where Troubles Occur (Building "A")

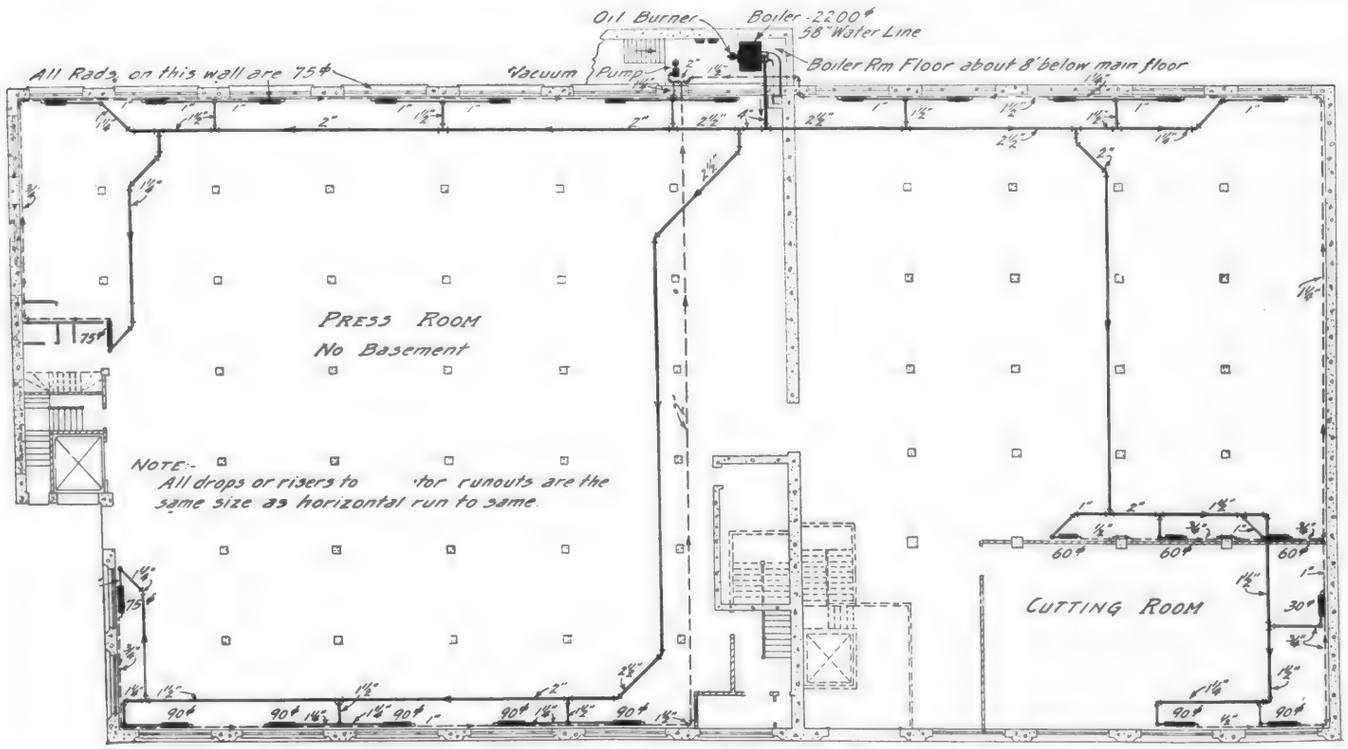

Oil Burner
Boiler 2200#
58" Water Line
All Rads. on this wall are 75#
Vacuum Pump
Boiler Rm Floor about 8' below main floor
PRESS ROOM
No Basement
NOTE:- All drops or risers to for runouts are the same size as horizontal run to same.
CUTTING ROOM

Fig. 2. A Vacuum Heating System With Water-Line Troubles (Building "B")

of the trouble is in the return mains or in the radiators.

Water leaves the boilers and stands in the piping, returning after the systems are shut down in an amount equal to the entire height of the water column. The radiators heat up fairly well, except the far radiators on the first floor in Building A (Fig. 1). These radiators heat up very slowly. All troubles seem to be confined to the vacuum system.

Building A is heated by means of an oil-burning boiler connected to two heating systems, one a down-feed gravity one-pipe system to upper floors, the other a vacuum-pump return system, with three supply mains to first floor and basement radiators.

The heating system in Building B is less complicated (Fig. 2). It is heated by means of an oil-burning boiler connected to a single heating system. The steam main is well overhead on the first floor above the radiators and the vacuum return is laid along the wall underneath the radiators, because there is no basement below. Radiators are mounted on 8 in. wood blocks, as shown in Fig. 3.

In both buildings the steam lines are well insulated, steam and return lines well drained and the ends of the steam mains in the vacuum-system trapped. Both steam and return pipe sizes are at least the sizes given in your Standard Data Sheets and, so far as we can determine, the installation is well made and standard in every respect. The vacuum pumps are located fully 10 ft, below the return mains in each case and seem to handle the water with ease.

The heating system in Building A was orginally intended for a one-pipe system throughout, but changes in the building when partly erected made it necessary to use a vacuum system for first-floor radiation. The boiler room was raised and the radiators on the first floor were lowered. They were at first set several feet above the floor in recesses in the wall.

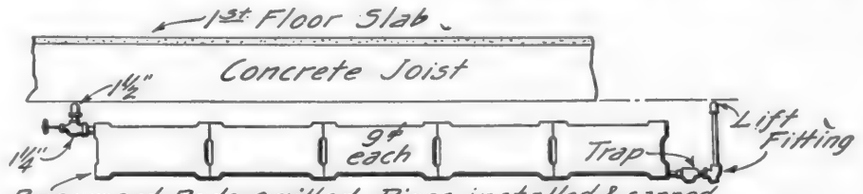


Fig. 4. Wall Radiators at Basement Ceiling with Lift Fittings at Return End (Building "A")

Radiators are omitted from the basement, but the necessary pipes and lift fittings are installed and capped (Fig. 4). A 5 in. steam main riser is carried to above the ceiling of the fifth floor and there connected to the down-feed one-pipe system, as shown by riser diagram in Fig. 5. This system eventually will be extended to three upper floors (See Fig. 6).

The coil in the hot water tank, shown in Fig. 7, is piped and cross-connected so as to be supplied by the small boiler (also equipped with an oil burner) in summer and by the main boiler in winter.

Heating of the cutting room in Building B was an after thought, so that extensions were made to the system at a later date, as shown in the plan (Fig. 2).

G. G. CHICK.
San Francisco, Calif.

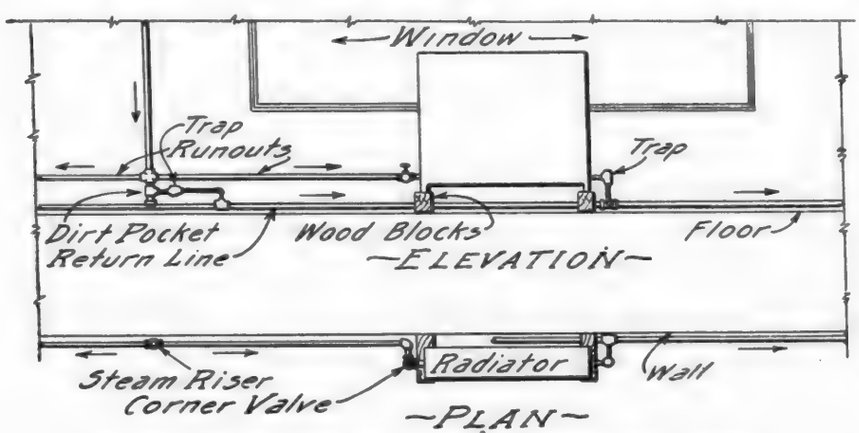


Fig. 3. Sketch of Radiators Set On Blocks With Return Beneath (Building "B")

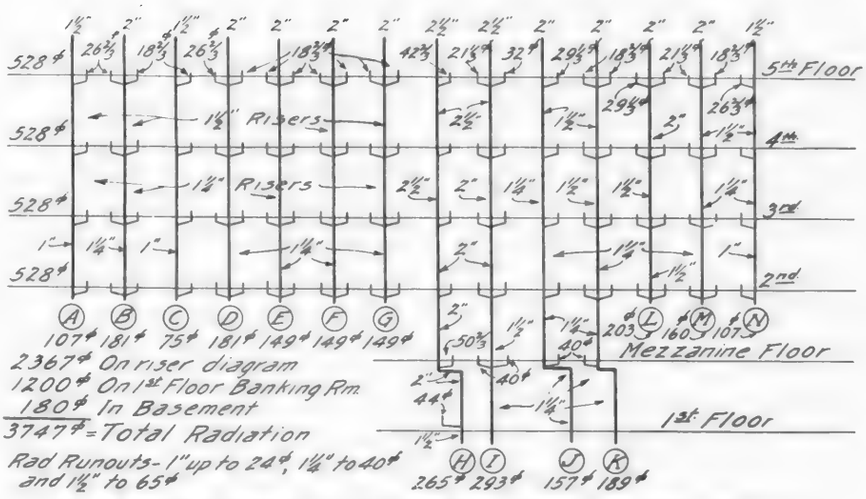


Fig. 5. Riser Diagram of Down-Feed Gravity One-Pipe System (Building "A")

Both installations show the usual symptoms of priming as caused by dirty water in the boiler and system. Probably 90% of unsteady boiler water-lines and apparent mysteries in heating systems are from such causes, especially in new systems, as we advised another correspondent in the Heating and Ventilating Magazine for August, 1923.

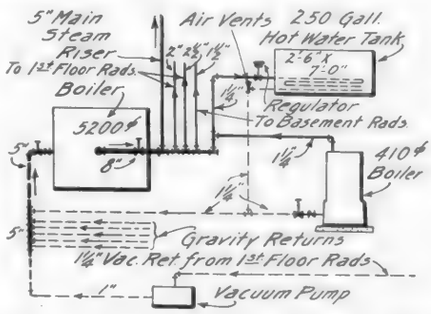


Fig. 7. Diagram of Boiler and Hot Water Tank Connection (Building "A")

Fig. 8. Typical Branch Connection At Roof Plan of Building "A"

Probably what happens is this—when the system is started from cold and pressure raised, water lifts and carries over, as stated. Make-up water is then admitted. When the system is cooled the water returns and floods the boilers. Under such conditions, raising the pressure will only serve to increase the trouble, due to increased priming and pressure drop.

Priming causes a drop in steam pressure, greatest at the far end of the system, so that boiler pressure acting on the return water holds it up until the pressure is removed. This would account for the trouble,

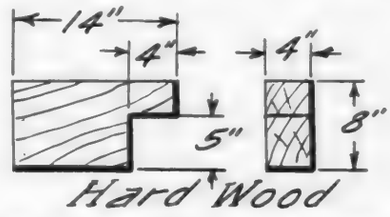


Fig. 9. Detail of Wood Blocks at Radiators

particularly in Building A, where the steam main is run at basement ceiling, as any water carried over would affect this floor, but would not be carried to upper floors. The vertical distance between the steam main and boiler water-line is not stated,

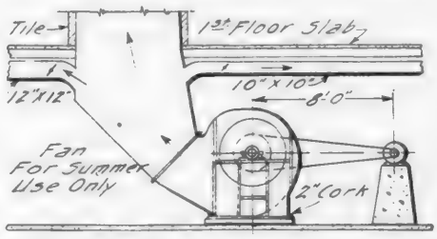


Fig. 10. Detail of Fan Installation

but it does not appear to be very much. So far as the returns are concerned, their distance above the water-line does not matter, as these are not gravity returned, but instead are positively returned by means of pumps.

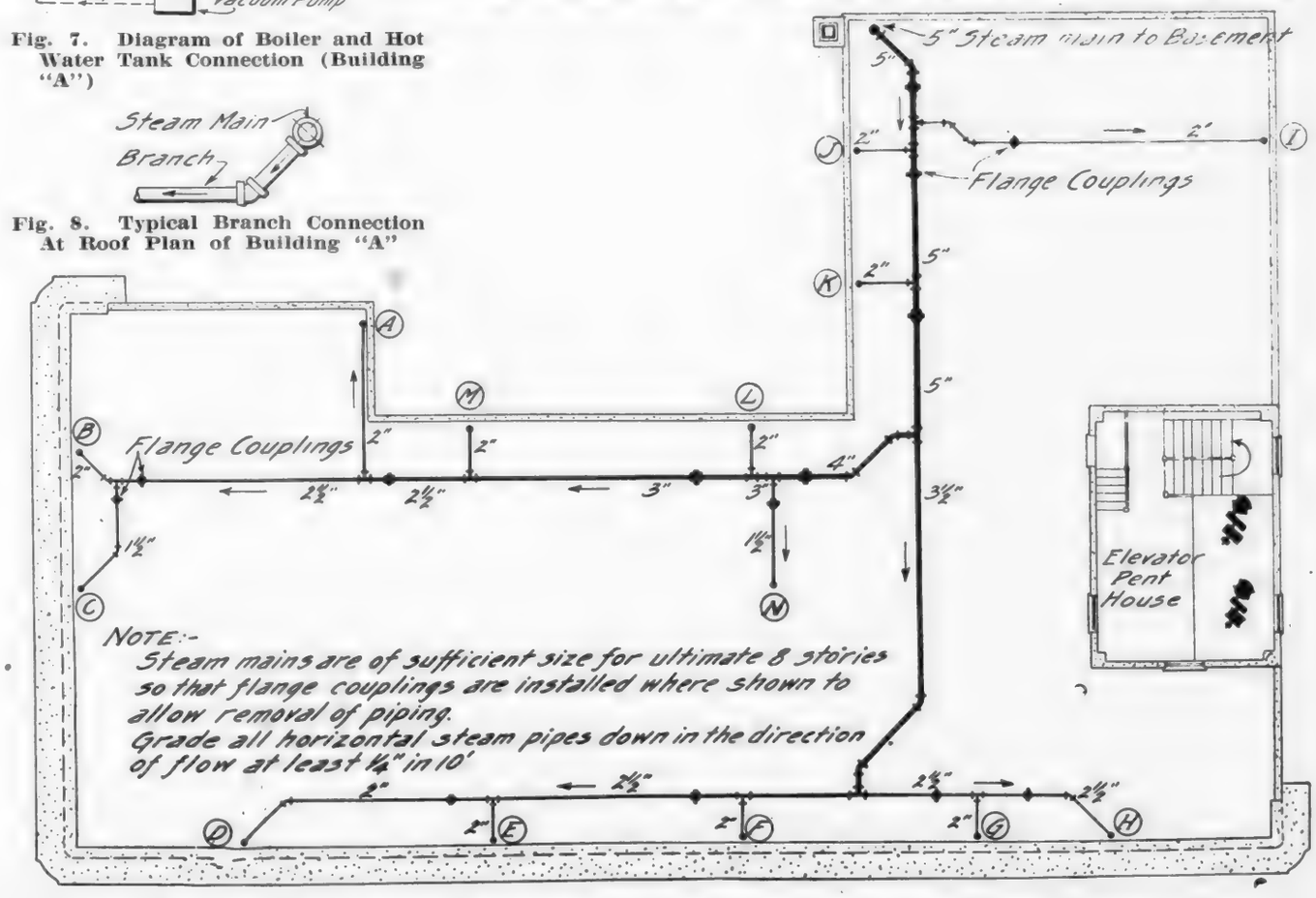

5" Steam main to Basement
Flange Couplings
Flange Couplings
Elevator Pent House
NOTE:-
Steam mains are of sufficient size for ultimate 8 stories so that flange couplings are installed where shown to allow removal of piping.
Grade all horizontal steam pipes down in the direction of flow at least ¼" in 10'

Fig. 6. Roof Plan Showing Distributing Mains to Down-Feed One-Pipe Risers (Building "A")

A simple way to test for priming is to raise the pressure to 10 lbs., attach a chain to the safety valve, then pull suddenly open at intervals and note whether dry steam is discharged from the safety valve. If not, then the system must be cleaned out, as well as the boiler, and it may take several cleanings before satisfactory results are secured. After each cleaning the job may work well for a time, then relapse, but finally the last bit of oil, grease, or core sand will be washed out.

Incidentally, it might be well to go over the traps and note their operating parts to see whether traps are clean, as they undergo a severe test in a new system until the system is freed of dirt.

It may also be said that while the boiler capacities and pipe sizes of the one-pipe system are adequate, some engineers would use slightly larger pipe sizes at certain points in the two vacuum systems, at least one size larger. This has reference mainly to the far ends of the system where the troubles occur and especially to the extensions made to the cutting room. Another point is that the radiators on the first floor of Building B are but a few inches above the return.

T. W. R.

Definitions of Common Terms used in Heating and Ventilating Practice

In view of the fact that the new Wisconsin Heating and Ventilating Code was the result of numerous conferences and hearings in which many heating engineers and contractors participated, the code definitions finally agreed upon will be found of more than ordinary interest. Following are those referring to the code itself:

Ventilation. The term "ventilation" shall be understood to mean and include the uniform production and maintenance of atmospheric conditions indoors conducive to health and comfort, and without detrimental drafts.

Positive Ventilation. The term "positive ventilation" shall be understood to mean and include ventilation which results from the use of positive inlets and outlets in conjunction with gravity or mechanical means of moving air.

Ventilation System. The term "ventilation system" shall be understood to mean and include any combination of building construction, machinery, devices, or equipment, so proportioned, arranged, installed, operated, and maintained, as to insure the standard of ventilation required by Orders of the Industrial Commission, under normal conditions of operation and maximum occupancy.

Heating System. The term "heating system" shall be understood to mean and incude any combination of buiding construction, machinery, devices, or equipment, so proportioned, arranged, installed, operated, and maintained, so as to produce and deliver in place the required amount and character of heating service.

Exhaust System. The term "exhaust system" shall be understood to mean and include any combination of building construc-devices, or equipment, s oproportioned, arranged, maintained, and operated, that noxious gases, dusts, fumes, vapors or other materials injurious to health, are effectively withdrawn from the breathing zone of employees and frequenters.

Gravity System. The term "gravity system" used herein shall be understood to mean and include any ventilation, exhaust, or heating system, the practical effectiveness of which depends wholly upon atmospheric conditions, such as relative density, temperature, and wind motion.

Mechanical System. The term "mechanical system" used herein shall be understood to mean and include any ventilation, exhaust, or heating system, the calculated practical effectiveness of which depends upon the operation of a power-driven equipment.

Air Supply. The term "air supply" shall be understood to mean and include the supply, appropriate distribution, and disposal of the fresh air required for ventilation.

Fresh Air. The term "fresh air" shall be understood to mean and include air that is stimulating and refreshing and which is free from contamination of any kind in proportions detrimental to the health or comfort of the persons affected thereby.

Note: Recirculated air from interiors of buildings, unless purified by approved apparatus in circuit, does not constitute fresh air as herein defined.

Fresh Air Intake. The term "fresh air intake" shall be understood to mean and include the ducts and outdoor openings through which outside air is admitted to the system served.

Positive Inlets and Outlets. The term "positive inlets and outlets" shall be understood to mean and include only those inlets and outlets which are definitely and specifically provided for such purposes.

Ducts. The term "duct" shall be understood to mean and include any pipe, flue, channel, or housing, used, or intended to be used, for the conveyance of air, gases, or entrained materials pertaining to a heating or a ventilating system.

Note: Vertical ducts are commonly designated as *"flues."*

Inlets. The term "inlet" shall be understood to mean an opening into a room or apartment through which the tempered fresh air enters the room.

(B) For the purpose of this code, the surfaces of solid fins, flanges or pins, projecting into airways, shall not be counted or included in the measurement of furnace or stove heating surfaces.

Outlets. The term "outlet" shall be understood to mean an opening from a room or apartment through which the spent air leaves the room.

Note: Outlets are commonly called "vents."

Outdoor Openings. The term "outdoor openings" shall be understood to mean and include only those outdoor openings which are arranged and equipped in such manner as to be easily operated and accessible for manipulation.

Note: To be counted, such openings must be in side walls or in roof monitors, at any angle greater than 45° from horizontal. Openings shall be counted only to the extent of the greatest possible net open area at one time. Thus, a check-rail window 3 ft. wide and 6 ft. high, with two sliding sash, generally has a net opening of only 9 sq. ft.

Boiler Heating Surface. The term "heating surface" applied to boilers, shall be understood to mean and include the total wetted area between grate-line and normal water-line, exposed to combustion of fuel or in intimate contact with flowing combustion gases on one side and water on the other side.

Note: Heated surfaces in steam spaces and ash-pit surfaces, although having some value, are not to be included in measuring the heating surface for purposes of this code.

Furnace and Stove Heating-Surface. (A) The term "heating surface" applied to furnaces and stoves, shall be understood to mean and include the total area of air supply surface between grate-line and smoke collar, exposed to combustion of fuel or in intimate contact with flowing combustion gases on one side and flowing air supply on the other side.

Note: Reasonable fins, pins and projections in air-ways are more or less valuable as heating surfaces, but the chief value of such projections appears to be derived from directive impingement of air currents upon primary and secondary heated surface.

Existing Buildings. The term "existing buildings" shall be understood to mean and include all buildings hereunder, and additions thereto and alterations thereof, structurally completed, or for which complete plans have been approved by, or have been duly filed with, the Industrial Commission or its authorized local representative, prior to effective date of these orders.

Occupied Areas. The term "occupied area" shall be understood to mean and include any room, area, or enclosure normal use of which involves actual or intended occupancy by one or more persons.

New Buildings. The term "new buildings" shall be understood to mean and in-

Public Health Summer Schools

The United States Public Health Service has announced that four of the large American universities will offer this summer short courses in public health service. The schools and dates of the courses follow: University of Iowa, Iowa City, June 9 to July 18; University of California, Berkeley, June 23 to August 2; University of Michigan, Ann Arbor, June 23 to August 2, with some courses extending another two weeks; and Columbia University, New York City, July 7 to August 15. The aim of the summer courses is to give up-to-date intensive training for all persons engaged in any kind of public health work.

William J. Baldwin

Who's Who In Heating and Ventilation

II–William J. Baldwin

WILLIAM J. BALDWIN, who is known as the dean of the heating and ventilating profession in the United States, commenced his engineering career at East Boston with the great Donald McKay, the "Prince of Shipbuilders." Donald McKay built the fastest clipper ships in the world and Mr. Baldwin, who was the son of a British naval architect, entered Mr. McKay's employ in the second year of the Civil War.

After Mr. Baldwin had assisted in the construction of three light draft monitors, the Casco, Squando and Nausset, and the reconstruction of a number of English blockade runners into United States cruisers, the Civil War came to an end, and Mr. Baldwin went to South America as a young naval architect in Brazilian service.

Returning to America in 1868, there was nothing to do in shipbuilding and, like many other engineers, he had to change his particular specialty. Chance drove him into the field of activity connected with the development of the great buildings of New York, and now, near the end of his eightieth year, he is still "in harness" in that field.

In his work as consulting heating and ventilating and sanitary engineer, Mr. Baldwin designed the mechanical equipment of such buildings as the New War College and the Washington Post building, in Washington. Some of his other important engineering assignments are mentioned without reference to their chronological order, but rather to bring out special problems in their design, the solution of which, in many cases, paved the way for the development of the art.

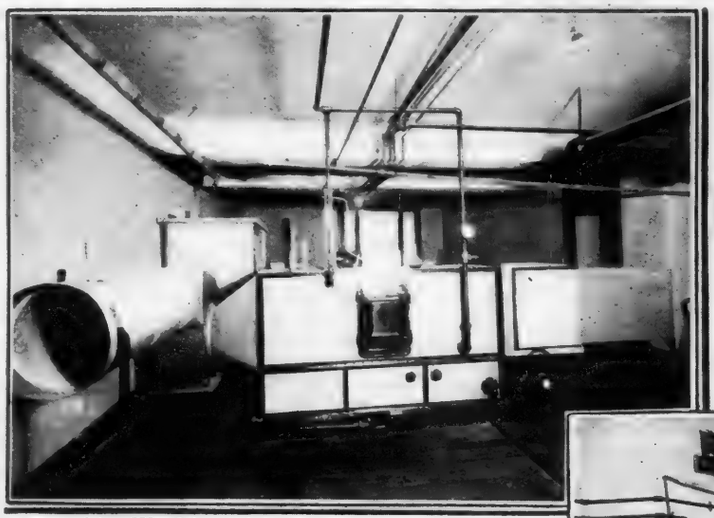
The United States Immigration Station, at Ellis Island, New York, for instance, was a special problem, the great peculiarity of which is that the steam mains and return pipes are nearly all in the attics of the various buildings, instead of in the basement, because of the eccentricity of the high tides, at times, in New York Harbor.

Nearly all large groups of buildings have a problem to overcome and the problem connected with the work at the National Home for Disabled Volunteer Soldiers, in Johnson City, Tenn., was that there are about forty scattered buildings on the reservation, with about three miles of underground mains, all returning the water of condensation to a power house at the top of the hill, on the highest part of the grounds. This, in Mr. Baldwin's judgment, was the proper place, to erect the power house and chimney so that the smoke from the soft coal would all be carried above the buildings.

EQUIPMENT OF NEW YORK'S EARLY "SKYSCRAPERS"

The office buildings of magnitude in New York City commenced with such structures as the Manhattan Company's building and the Merchants' Bank Building, at 40-42 Wall Street in about 1882.

Engineering Illustrations



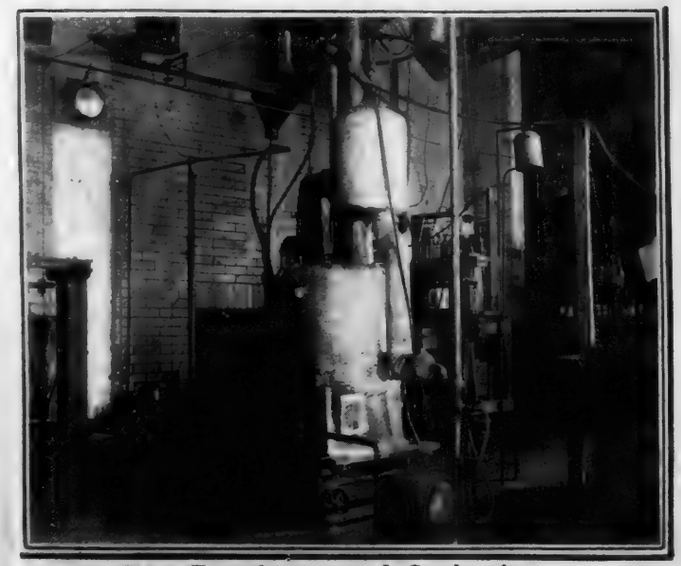
Air Washing Apparatus Being Used in Developing a Code for Determining the Effect of Dust Removal of All Types of Dust Eliminators.

Test to Determine Physiological Reactions of Humans to High Temperatures and Humidities in Test Chamber.

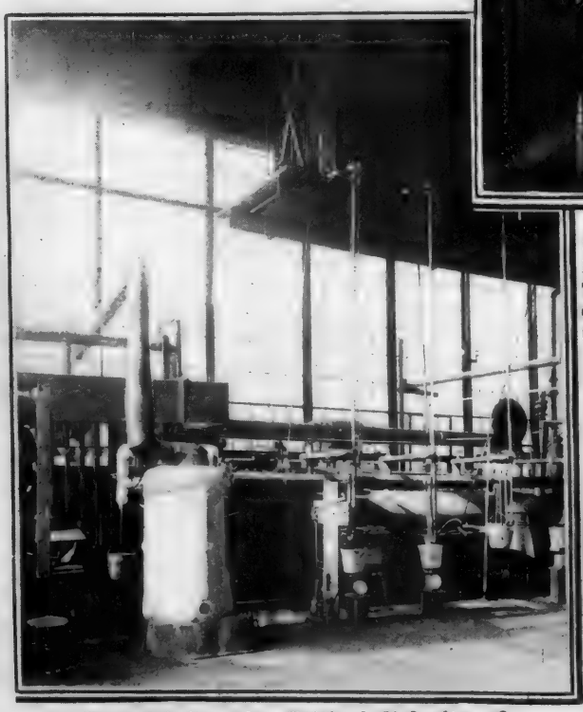
Pittsburgh Experiment Station of the United States Bureau Mines

Gas-Tight Chamber or Manhouse in Which Effects of Various Gases Upon Man are Studied.

Recording Bo... meters of Men ... Room by Mean... Thermometers ... couples and Se... trical Instrume... The... Adju... Ele...



Heat Transference and Combustion Test in a Small Domestic Heating Boiler.



Determining the Critical Velocity of Steam in Pipes with Counter Flow of Condensate.

Views of the Research Laboratory, A. S. H. & ...

Progress
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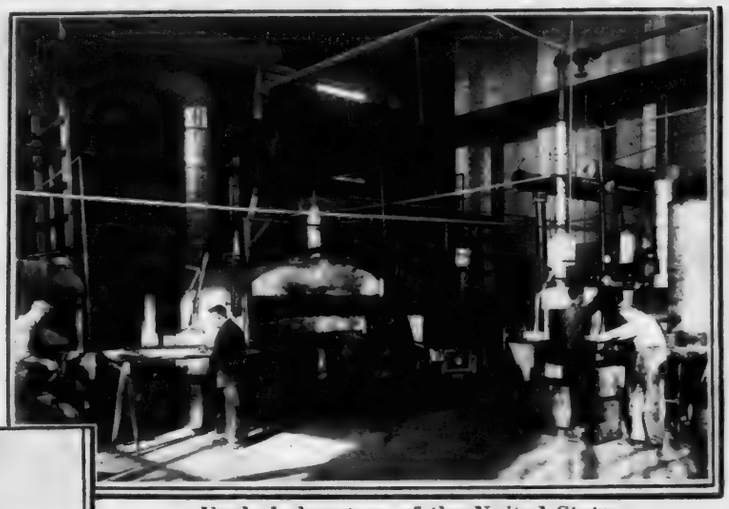
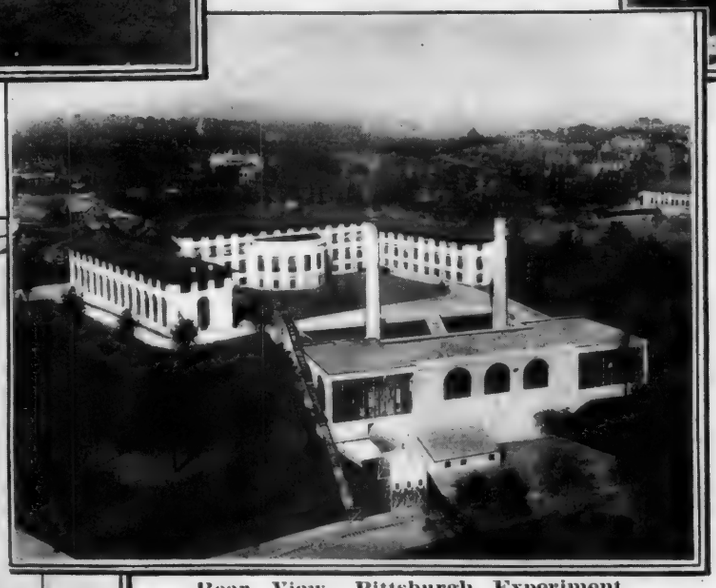
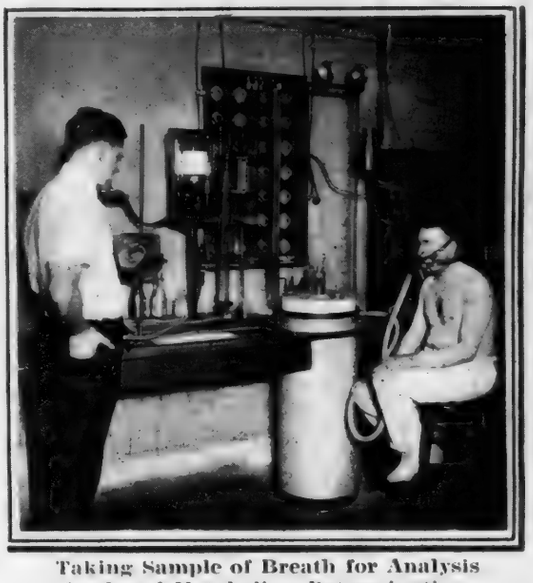


Fuels Laboratory of the United States Bureau of Mines, Where Tests on Various Fuels Are Made with Different Types of Boilers.

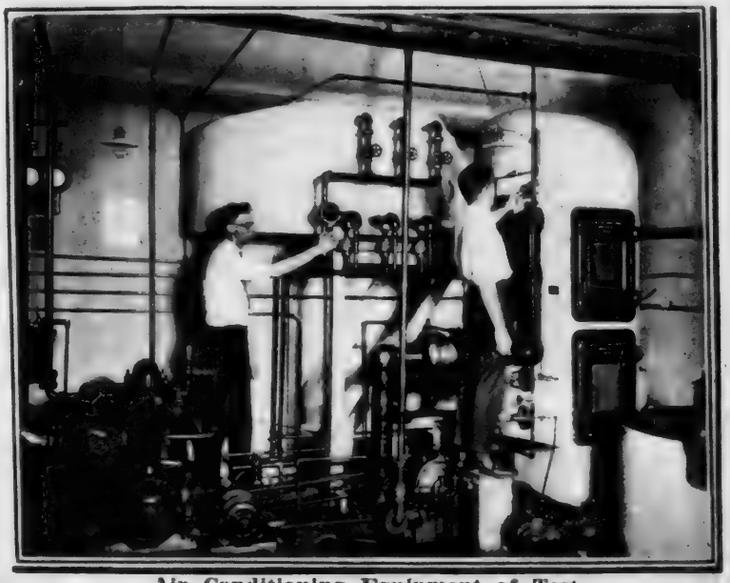


Rear View, Pittsburgh Experiment Station of the U. S. Bureau of Mines.



Taking Sample of Breath for Analysis for Local Metabolism Determination.

Automatically Recording Systolic and Diastolic Blood Pressures.



Air Conditioning Equipment of Test Chamber at A. S. H. & V. E. Research Laboratory.

& E. and of the Tests Being Conducted There

Who's Who in Heating and Ventilation

Continued from page 67

The problem here was the design of what is known as a "fractional" system, in which steam could be admitted and graduated fractionally to the radiators, thus permitting the graduation of the steam heat. This work was done in 1882 and the graduating valves are still in operation, without renewal, after a period of over forty years. The New York Tribune Building, the first newspaper office of any importance to install electric lighting, was Mr. Baldwin's work; the old plant is in operation today.

Mr. Baldwin was consulting engineer for several of the buildings of the Winchester Repeating Arms Company, the problem being to permit the air to pass up in front of the windows and not escape into the faces of the workmen at the fronts of the benches. Mr. Baldwin was the designer of one of the first types of "mushroom" ventilators to go under the seats of auditoriums of public buildings. They were first put into the Lecture Room and Amphitheatre of the College of Physicians and Surgeons, New York City; then in the auditoriums of the Vanderbilt Clinic and, later, a modified form, without adjustment, of a goose-neck type, was designed for the Symes Operating Theatre, a branch of the Roosevelt Hospital.

SPECIAL REQUIREMENTS OF HOSPITAL AND MEDICAL BUILDINGS.

Among the hospitals and medical building plants to Mr. Baldwin's credit are the Harlem Hospital, the Riverside Hospital of the Board of Health, the great group of hospitals known as the Willard Parker Hospitals of New York City, the Kingston Avenue Hospital group of the Board of Health in Brooklyn, including its power house and underground system; the Sloane Maternity Hospital; the Vanderbilt Clinic and the College of Physicians and Surgeons, done about 1886-1887. The latter were the first buildings warmed and ventilated by a parallel system of warm and cold air ducts carried to each room or ward of the building.

These buildings had a special treatment. The air was taken into settling chambers whose floors had from 6 in. to 1 ft. of water in which to permit the dust to settle and also to provide means for regulating the humidity. The air was then warmed to 50° or 60° F. in these chambers and passed to the fans. After passing the fans, the air was further warmed to the desired temperature for the building.

About one-half of all the air admitted received only the first increment of heat and passed into the cool ducts. The higher-temperature air was then passed into the second set of ducts and the relatively cold air was passed into another set of ducts. The two volumes of air did not meet again until they came together in the register heads within the rooms. Each occupant was thus able to regulate the temperature of the air to suit himself. He could take it at 60° F. or he could take it at 80° or at any intervening point.

The William J. Symes Operating Theatre of the Roosevelt Hospital was another typical example of Mr. Baldwin's work. As this structure was built and stands today, a sterilized water hose can be played into it, if necessary, and no water can get into the air ducts.

The great group of tuberculosis hospitals built by the Commissioners of Charity of the City of New York, on the topmost hill of Staten Island, and known as the Sea View Hospital, was engineered by Mr. Baldwin. This is one of the most advanced hospital groups to be found in New York City.

A LARGE DRY-GOODS STORE INSTALLATION

Among dry-goods stores, Mr. Baldwin is responsible for the ventilation of the Abraham & Straus store in Brooklyn. Although these buildings show no heating or ventilating apparatus, no less than 6,000,000 to 10,000,000 cu. ft. of air are passed through them every hour without anyone being the wiser as to where the air comes from or where it goes out.

Among other institutions Mr. Baldwin is responsible for the ventilation of the Elmira Reformatory for Young Men, the Hebrew Orphan Asylum of Brooklyn, and the Stillman Memorial Home for the Aged, Brooklyn. His installations in churches would comprise a large list by themselves. Among schools, whose equipment he designed, are the Vanderbilt Memorial Hall, at Yale; the Peekskill Military Academy; Trinity School, New York; and St. Agatha's School. The special problem at St. Agatha's was that the fresh air had to be carried in the attic through metal ducts and the air forced downward to the various points of delivery against the natural tendency of the warm air, and accomplish equal delivery according to the number of scholars in each room, at the same time carrying out what was then known as the requirement of the Massachusetts School Law of 30 cu. ft. of fresh air per capita per hour.

Among the Masonic Temples which Mr. Baldwin engineered is the classical Temple of Brooklyn, New York. Other important buildings that come to mind are the Livingston County Court House, Genesee, N. Y.; New York State Reformatory, Elmira, N. Y.; State prisons at Ionia, Mich., and Jackson, Mich.; and numerous Carnegie libraries, notably the great library in Torrington, Conn.

Among Mr. Baldwin's more recent work should be mentioned the design of the power house and heating systems for the Lackawanna Railroad Terminal in Hoboken, N. J., as well as the Lackawanna terminal at Twenty-Third Street, New York. Among his important residence installations is that for the home of Senator Clark, on Fifth Avenue, New York, in which the engineering plant ran into nearly $1,000,000.

VENTILATION OF TELEPHONE AND ELECTRIC CONDUIT SUBWAYS

Mr. Baldwin was consulting engineer for the ventilation of the telephone and electric conduit subways for the Empire City Subway Company. It was in these telephone subways that the great danger to the lives of the employees from carbon monoxide was first brought to the attention of the engineering work and means taken to guard the health of the employees so that only two deaths have been recorded from that cause since 1888. It was not generally known at the time that the New York Telephone Company went to the expense of installing compressed air pipes from Stone Street, near the Battery, New York, to the Harlem River, and established six blowing plants, so that a slight plenum condition was maintained in all the electric subways, preventing the natural ground pressure from forcing gas into the manholes, until the condition that then prevailed underground (1888) was overcome and a condition of plenum maintained in the electric subways throughout the streets of New York City.

MR. BALDWIN AS AN AUTHOR

Among Mr. Baldwin's works on subjects connected with heating and ventilation are "Baldwin on Heating," which is now in its nineteenth edition; "Hot Water Heating and Fitting" (third edition); "Data for Heating and Ventilation," "An Outline of Ventilation and Warming," and "The Ventilation of the School Room." He was engineering editor of *The Sanitary Engineer* under the elder Henry C. Meyer for nine years, from 1879 to 1888. It is to the foresight of Mr. Meyer, declares Mr. Baldwin, that sanitary engineering made the strides which led later to the compilation of the Sanitary Code of New York City.

Mr. Baldwin is an honorary member of the American Society of Heating and Ventilating Engineers, a life member of the American Institute of Architects, Brooklyn Chapter; a member of the American Society of Civil Engineers (1884); a member of the American Society of Mechanical Engineers (1883); a Telephone Pioneer of America, and other engineering societies. He was a member of the Committee of the A. S. M. E. (1886) which recommended the adoption of the Briggs Standard for Pipes and Pipe Threads as the U. S. Standard, now so widely known as the "American Standard." Mr. Baldwin was also a member of the international commission which worked from 1906 to 1914 to secure an International Standard for Pipe Threads, but the Great War destroyed the work of the commission, except to leave a history of what was and what probably can be done by others.

Massachusetts Commission Proposed to Study Air Conditions in Buildings

A proposed resolution to appoint a commission to study the problem of disturbing normal moisture content of air in heating buildings has been offered by Mr. Conroy, of Fall River, Mass., on petition of William S. Conroy, in the Massachusetts legislature (House Bill No. 864). The unique character of the proposed investigation lends special interest to the wording of the bill, which is as follows:

"*Resolved*, That the commissioner of health, the commissioner of labor and industries and the commissioner of public safety be designated by the governor as a special commission for the purpose of investigating the problem of air conditioning by moisture in factories, office buildings, mercantile and industrial establishments, in state and other public institutions, schools, hospitals, etc.,—with especial regard to the maintenance of a better relationship between the humidity or moisture percentage and the temperature of air during the season of the year when artificial heating disturbs such, to the end that the more wholesome relationship which exists outdoors may be more nearly approached.

"The commission may employ such special assistance as may be necessary to insure a thorough investigation of this problem and shall be given such supplementary powers in reference thereto as are consistent with existing legislation regarding inspections and investigations, and may expend for travel and other expenses from an amount not exceeding $5,000, as may be appropriated by the general court such sums as may be approved by the governor and council.

"The commission shall report its findings and recommendations on the aforesaid matters with drafts of any legislation that may be deemed necessary to carry such recommendations into, to the general court on or before the first Wednesday in February 1925."

New Heating Code for Roanoke, Virginia

According to the provisions of the new heating code of Roanoke, Va., which has been furnished us through the courtesy of D. P. Maginn, building inspector of that city, Roanoke has taken an advanced stand regarding both warm-air furnace installations and steam and water heating work.

The code starts off by specifying that all pipes or conductors to be used for the transmission of hot air, or for heating purposes in any building shall be made of two sheets of tin or other suitable metal fastened together so as to leave air space of not less than ¼ in. between the sheets of metal. Where they enter the wall they must be first firestopped and all pipes running in sliding door partitions must be lined with asbestos and galvanized-iron. Other rules, in this connection, refer to warm-air registers and warm-air flues.

Steam and water heating pipes, it is provided, shall not be placed within 2 in. of any timber or woodwork, unless the woodwork is protected by a metal shield, then the distance shall not be less than ¼ in. on each side.

All steam and water heating pipes passing through floors and ceilings or lath and plastered partitions must be protected by a metal tube passing entirely through floor and ceiling or partitions 1 in. larger in diameter than the pipe, having a small metal cap at the floor. When run in a horizontal direction between a floor and ceiling a metal shield must be placed on the underside of the floor over them and on the sides of wood beams running parallel with said pipes.

Another provision is that no natural or artificial gas shall be burned in any grate, furnace, water heater or range, unless there is a connection with a suitable flue for carrying off the products of combustion.

Dry-cleaning rooms must be equipped with steam pipes extending around the said rooms at the floor and ceiling lines. From these steam pipes there must be openings or jets at intervals not exceeding 12 in. This steam system shall be controlled by a lever valve located outside of said dry-cleaning room.

Brickset boilers, it is provided, shall not be supported on beams or floor construction made of wood or other combustible material. A portable boiler may be supported in this manner, but in any such case the floor must be protected by a covering not less than 4 in. thick, of concrete or brick laid in cement mortar. Such a covering must be constructed upon a continuous sheet-metal plate not less than 3/16 in. thick, having all joints riveted and the edges turned up 4 in. on all sides. This floor covering shall extend under the whole of the firebox and ash-pit of the boiler and shall extend outwardly not less than 2 ft. in front and not less than 1 ft. on the other three sides.

No combustible wall or partition may be within 4 ft. of the sides or back, or 6 ft. from the front of any boiler or other heating apparatus, unless said wall or partition is covered with metal to a height of at least 4 ft. above the floor, and this covering must extend from the end or back of the boiler to at least 5 ft. in front of it; then the distance may not be less than 2 ft. from the sides and 5 ft. from the front of the boilers.

The smoke-pipe connecting the heater to the flue must be made of No. 24 galvanized-iron and where same is within 3 ft. of joists or other woodwork, said woodwork shall be covered with ⅛ in. asbestos mill-board and sheet-metal 30 in. wide, this protection to follow the contour of the joists and floors so as to leave no concealed spaces.

Proposed Industrial Code For Laundries

The Department of Labor of the State of New York has published its proposed rules for the construction, equipment, maintenance and operation of laundries.

"Excessive heat" is defined in the code as meaning a dry-bulb temperature in the workroom in excess of 80° F. when the wet-bulb depression or difference in reading between the dry-bulb and wet-bulb temperatures is less than 8° F. and the outdoor temperature is 70° F. or less. It shall also be construed to mean when the workroom dry-bulb temperature exceeds by 10° of more the dry-bulb temperature recorded outdoors when the outdoor temperature is more than 70° F.

"Excessive humidity" shall be construed to mean a moisture content of air within the laundry when the wet-bulb depression or difference in reading between the dry-bulb and wet-bulb temperatures is less than 8° F. and the outdoor dry-bulb temperature is 70° F. or less.

Tests for the determination of excessive heat or excessive humidity shall be taken with standardized thermometers the wet-bulb reading taken in rapidly-moving air and the dry-bulb taken simultaneously in still or moving air in zones regularly occupied by workers.

The rules provide also that every workroom shall be ventilated by an approved method of natural or mechanical ventilation or by both.

Two types of mechanical ventilating systems are presented, one local and the other general. In the former it is required that a local method of exhausting the air and vapors from the workroom through hoods, pipes and cuts must be provided and rules are laid down for the installation of such exhaust systems.

The general system of ventilation is covered under four rules: an approved general system of ventilation by means of plenum system with natural or mechanical means to exhaust air from workroom; a vacuum system; an approved general system of ventilation by means of fans installed in walls, monitors, roofs, ducts, etc.; and fourth, any other approved means of ventilation.

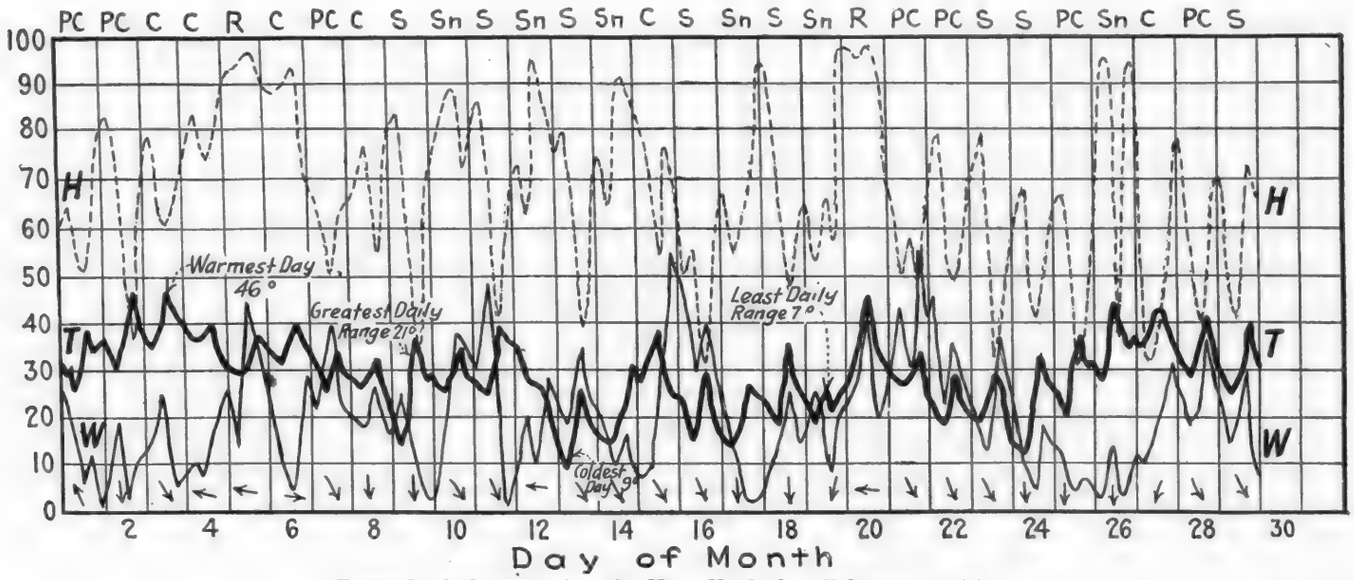
How to Help in the Movement to Procure Increased Pay for Letter Carriers.

Everyone interested in good mail service will, no doubt, want to help along the movement to secure better pay for letter carriers and postal clerks. This may be done by urging favorable action on the Edge-Kelly bill, now being considered by committees in the Senate and House at Washington. This measure provides for a minimum salary of $2,000 per annum for letter carriers and postal employees. High-grade men, it has been pointed out, are no longer attracted to post-office positions which pay only $26.92 per week minimum, after three years' service, and $34.61 maximum. Those desiring to aid the movement can do so by writing their views to the senators and congressmen having charge of the Edge-Kelly bill designated as S. 1898 and H. R. 4123. These committees are made up of Representatives W. W. Griest, Nicholas Longworth and C. D. Page, and Senators Thomas Sterling and Henry Cabot Lodge, respectively.

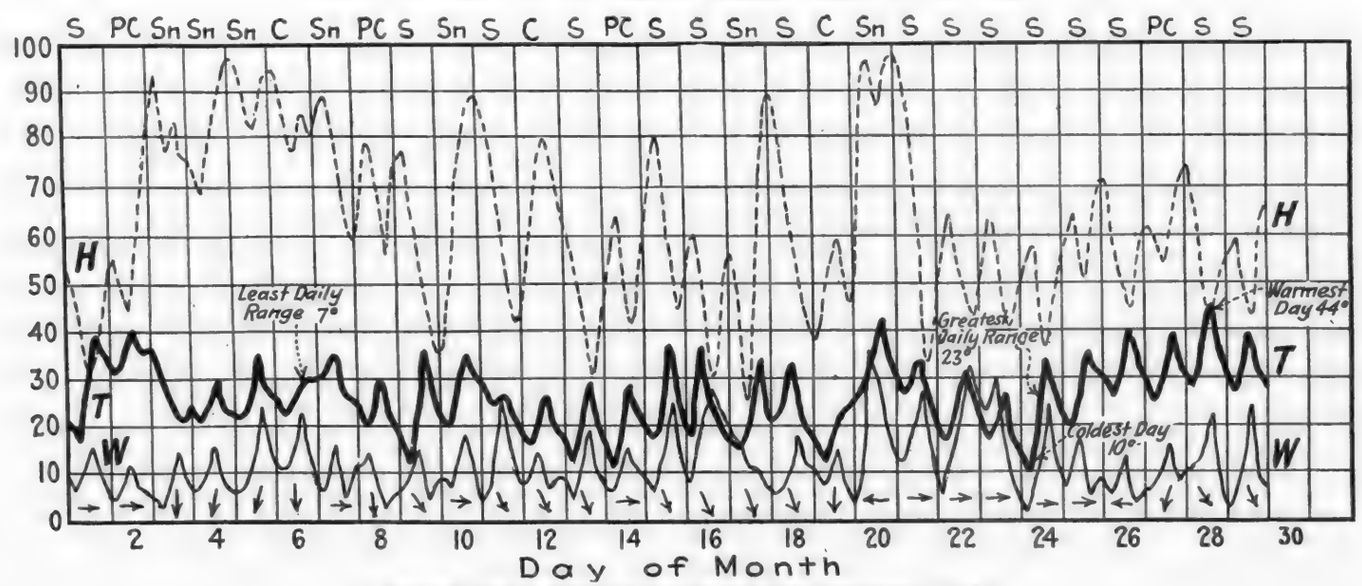
TRADE RELATIONS is the title of a pamphlet issued by the Chamber of Commerce of the United States, telling what is being done by dozens of trade associations to destroy unfair practices and to improve the conditions surrounding the purchase and sale of commodities. Copies may be obtained gratis from the Domestic Distribution Department, Alvin E. Dodd, manager, Mills Building, Washington, D. C.

The Weather for February, 1924

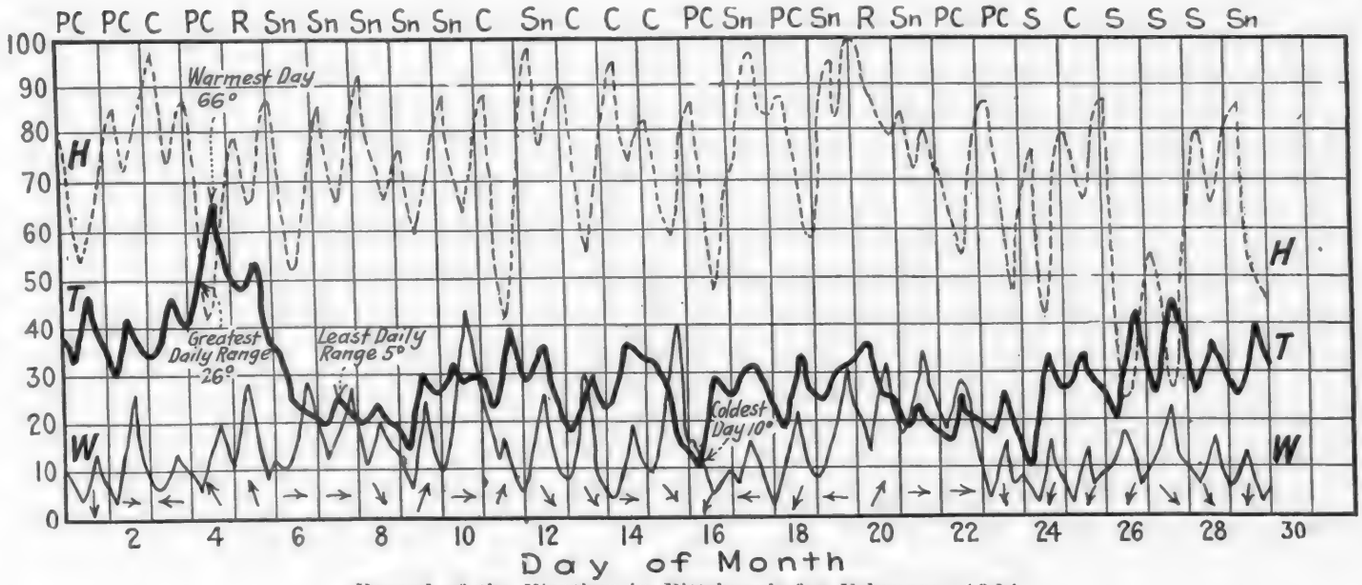
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest Temperature, deg. F	46	44	66	44	66
Date of highest temperature	3	28	4	27	3
Lowest temperature, deg. F	9	10	10	10	13
Date of lowest temperature	13	24	16	22	6
Greatest daily range, deg. F	21	23	26	18	30
Date of greatest daily range	9	24	4	26	2
Least daily range, deg. F	7	7	5	3	3
Date of least daily range	19	6	7	3	17
Mean temp. for month, deg F	29.2	26.6	29.3	28.8	35.6
Normal mean temp. for month, deg. F	31.3	28.8	32.3	27.5	34.5
Total precipitation, in	3.84	2.61	2.59	1.68	1.29
Total snowfall, in	10.7	10.4	11.6	7.7	2.3
Normal percipitation, in	3.87	3.56	2.66	2.24	2.75
Total wind movement, miles	12842	7458	8099	8685	9143
Average hourly wind velocity, miles	18.5	10.7	11.6	12.5	13.1
Prevailing direction of wind	N. W.	W.	W.	N. W.	N. W.
Number of clear days	9	15	4	6	14
Number of partly cloudy days	7	6	7	4	5
Number of cloudy days	13	8	18	19	10
Number of days on which rain fell	2	0	3	0	5
Number of days on which snow fell	8	7	10	7	3



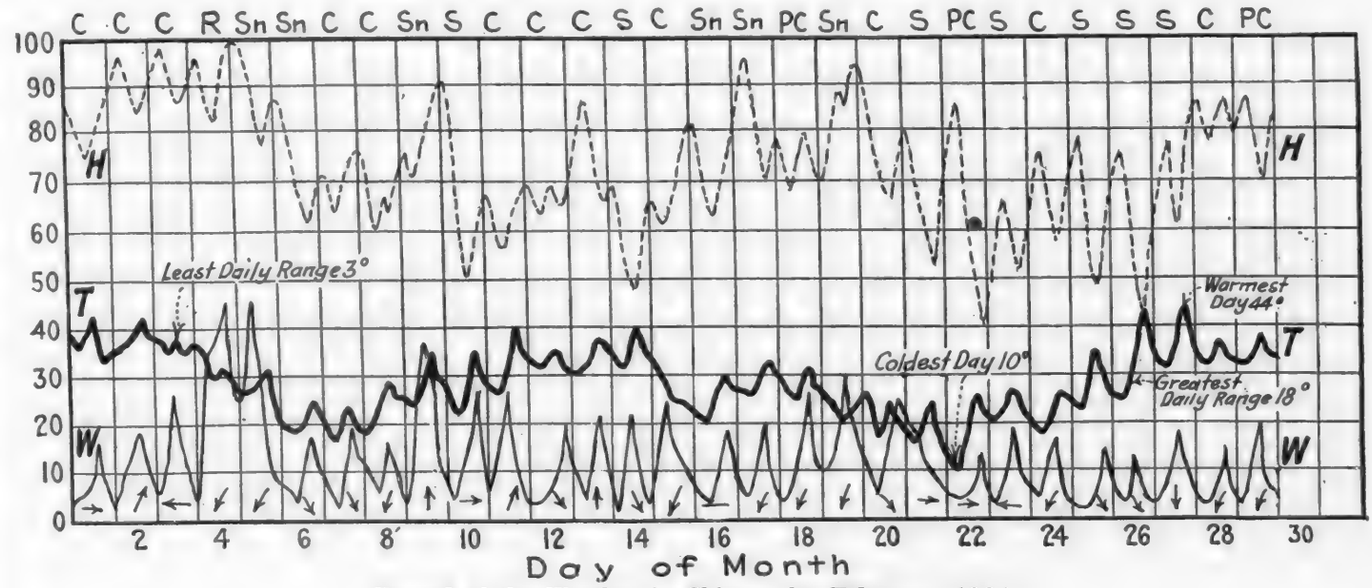
Record of the Weather in New York for February, 1924
(Hourly Observations of the Relati ve Humidity Plotted on this Chart)



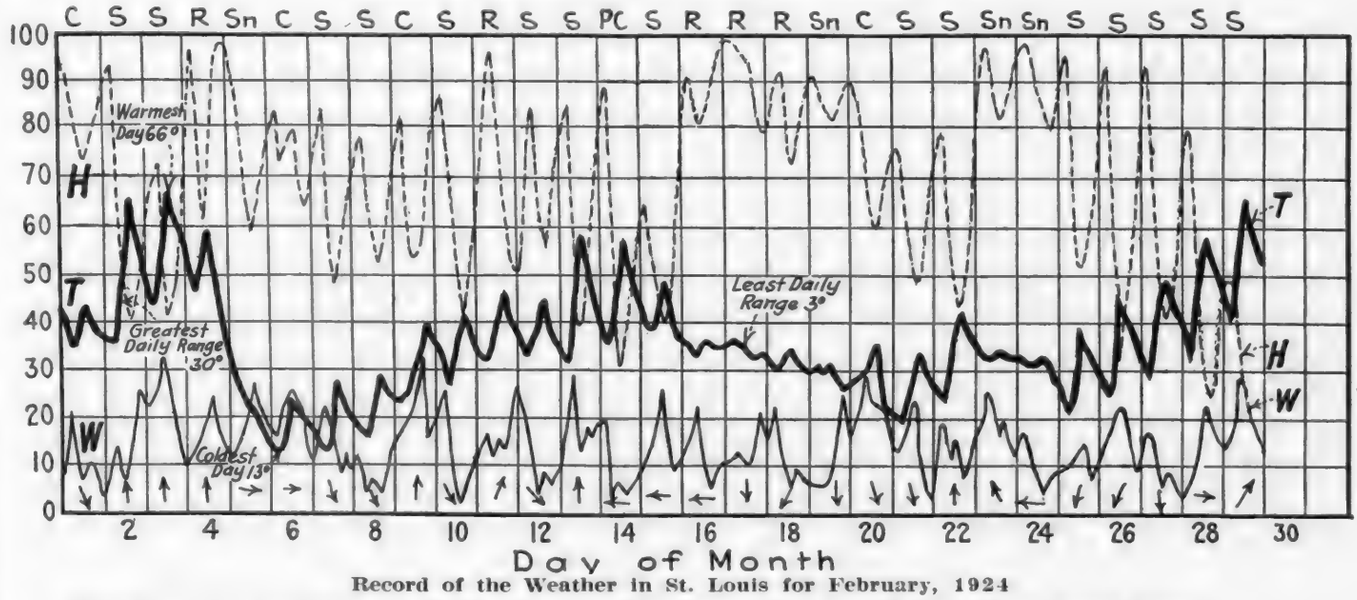
Record of the Weather in Boston for February, 1924


PC PC C PC R Sn Sn Sn Sn Sn C Sn C C C PC Sn PC Sn R Sn PC PC S C S S S Sn
Warmest Day 66°
Greatest Daily Range 26°
Least Daily Range 5°
Coldest Day 10°
H
T
W
Day of Month

Record of the Weather in Pittsburgh for February, 1924


C C C R Sn Sn C C Sn S C C C S C Sn Sn PC Sn C S PC S C S S S C PC
Least Daily Range 3°
Coldest Day 10°
Warmest Day 44°
Greatest Daily Range 18°
H
T
W
Day of Month

Record of the Weather in Chicago for February, 1924


C S S R Sn C S S C S R S S PC S R R R Sn C S S Sn Sn S S S S S
Warmest Day 66°
Greatest Daily Range 30°
Coldest Day 13°
Least Daily Range 3°
H
T
W
Day of Month

Record of the Weather in St. Louis for February, 1924

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A. M., 12 M., and 8 P. M.
S—Clear, PC—partly cloudy, C.—Cloudy, R—rain, Sn—snow. Arrows fly with prevailing directions of wind.

American Society of Heating and Ventilating Engineers

Western New York Chapter Discusses Gas as a Fuel

Gas as a fuel, with particular reference to house heating, was the principal topic for discussion at the March meeting of the Western New York Chapter, held in Buffalo, March 10, at the Hotel Lafayette. The subject was presented by J. E. Kinner of the Bryant Heater & Mfg. Co., of Cleveland. Mr. Kinner began his address by stating that in cities where the gas supply is assured, people are turning to gas as the logical solution of their heating problem.

"Many of us," he continued, "can remember when they started to harness Niagara Falls for power, and we dreamed of the time to come when we could afford to heat our home with the energy developed by the different hydro-electric power plants throughout the country. The years have rolled by since then and we awaken from that dream. And today we find the city of Buffalo almost within hearing distance of the mighty cataract that made possible one of the largest hydro-electric power plants in the world —Buffalo, the Electric City,—the streets still lighted with gas lights.

"The gas industry has demonstrated its right to exist from an economic standpoint as a public servant and as a conservator of our natural resources. As a public servant she stands ready at all times to serve us with a convenient fuel. As a conservator of our natural resources she conserves to our use many important chemicals from her by-products. One ton of the average bituminous coal, besides furnishing 10,000 cu. ft. of gas, supplies 2½ gals. of benzoil, 22 lbs. of ammonia and 9 gals. of coal tar which is used extensively in the manufacture of dyestuffs, medicines and many other articles of commerce.

"You have at present in the City of Buffalo a mixed gas carrying a heat value of not less than 800 B. T. U. per cubic foot at 60c per 1000 cu. ft. F. O. B. your heating appliance. Comparing this with coal, we find that 1 lb. of the average coal contains about 12,000 B. T. U. Compared with 800 B. T. U. in a cubic foot of gas, we find that 1 lb. of coal is equivalent to 15 cu. ft. of gas; so that one ton of coal would be equivalent to 30,000 cu. ft. of gas at 60c per 1000 cu. ft.—$18.00. So that heat unit for heat unit an 800 B. T. U. gas at 60c per 1000 cu. ft. is equivalent to coal at $18.00 per ton. The average coal-fired house-heating appliance used in connection with a central-fired heating system is from 50% to 60% efficient. A coal-fired power boiler of the most approved type, with an equipment of the utmost refinement in the way of automatic stokers and draft control, if it develops an efficiency of 75%, is doing well. Laboratory tests made in some of the largest engineering schools of the country—in the laboratories of the gas industry and under actual working conditions—show that a high-grade appliance designed and built for the use of gas as a fuel, and to be used in connection with a central-fired heating plant, develops an efficiency of from 80% to 85%, based on the gross B. T. U. content of the gas, and 90% based on the net B. T. U. content of the gas. Allowing that a coal-fired house-heating appliance is 60% efficient, and that the gas-fired equipment is 80% efficient, and deducting for this difference in efficiency between the two appliances, we find that an 800 B. T. U. gas at 60c per 1000 cu. ft. is equivalent to $14.40 coal. Now we have made no allowance for labor in stoking the coal-fired equipment; we have made no allowance for the replacing of ruined decorations; we have made no allowance for the difference in control between an appliance using a solid fuel and one using a gaseous fuel where the element of human labor does not enter into the regulation.

"In the case of an appliance using a solid fuel we must accept conditions as they exist. With an appliance burning a gaseous fuel, we can make the conditions. The fuel is always uniform in quality and the supply can be made continuous to the appliance.

"The question naturally arises 'This being the case, why are not more buildings heated with gas?' You have never to my recollection, up to the present time, had an assured supply of fuel gas in the City of Buffalo, and the old rate on the manufactured gas was never conducive to very much economic heating. But we understand that at present your local gas company is erecting a three and a half million dollar plant for the manufacture of gas, so that in the future the supply of gas for Buffalo is assured. In the manufactured gas territory, where they have never had the natural gas, the gas industry has, up to a few years ago, looked askance at the heating load. It had visions of a high peak load in winter, necessitating an outlay for extra plant equipment which would lie idle during the summer months. But I believe that they now find that, due to the fact that the public is becoming so well sold on the idea of gas as a fuel, it is being used more extensively during the summer months for industrial work and for the heating of large hot water storage systems. In the larger cities the office buildings, hotels and large apartment houses were formerly equipped with their own power plant for generating the lighting current and for the operation of their elevators. They now find that they can buy this power cheaper from the companies who make that their business, so they have cut down the pressure on their power units and use them for heating of the buildings and for the heating of their hot water storage systems in the winter. For summer use they install an automatic gas-fired steam boiler and automatically heat their water through the summer months. The reason for installing a steam boiler, rather than a direct circulating system, is that with the indirect steam system they eliminate the necessity of passing the water heated through the appliance itself, so that the lime and sediment that would ordinarily be deposited in the tubes of the heater is deposited in the form of mud in the bottom of the storage tank where it can be scraped out through the manhole.

"In regard to burners and appliances it is a matter of common knowledge that any amount of gas burned in a common open burner, which thoroughly consumes it in a room, will throw out just as much heat as the same amount of gas burned in any burner and enclosed in the most elaborate and expensive jacket, or housing, and with the most complicated fire travel. It is also a matter of common knowledge that it is not safe nor a sane thing to do living in a room heated with an open gas burner without a suitable flue connection to the outside atmosphere to carry off any by-products or combustion there might be. In the case of an appliance to be used in connection with a central-fired heating plant, after you have erected an approved burner system, it is then a matter of designing and installing an absorbing surface that will extract and distribute all the heat units possible from the fuel consumed compatible with perfect combustion. But there is no burner, or appliance, made or to be made that will extract and distribute any more heat units than the fuel it is supplied with contains.

"It is upon you as a society and as individual engineers, that the public must depend for its education along these lines and for the safeguarding of its interest."

The April meeting, it was announced, will be a joint meeting with the local chapter of the American Society of Mechanical Engineers. Among the guests will be Dean F. Paul Anderson and the senior class of the University of Kentucky.

President Hutzel read a letter from Chief Smoke Inspector Supple of Buffalo, asking the chapter to take charge of one of the luncheons during the convention of the Smoke Prevention Association, to be held in Buffalo, June 3-5. It was voted to appoint a committee to carry out this request, thus marking what is believed to be the first move towards co-operation between the American Society of Heating and Ventilating Engineers and the Smoke Prevention Association.

Secretary C. W. Obert's Record with the A. S. H. & V. E.

An appreciative account of the record of Secretary C. W. Obert, who has just retired as secretary of the American Society of Heating and Ventilating Engineers, is contained in the current issue of the society's *Journal*. During the eight years of his connection with the society, the membership has grown from 550 to nearly 2000, while the number of chapters has grown from three to fourteen.

Mr. Obert will devote a part of his time to consulting work in the manufacturing field, and the remainder will be devoted to the A. S. M. E. Boiler Code Committee work, of which he has been secretary for several years.

New Members of the A. S. H. & V. E. Committee on Research

W. H. Driscoll and C. V. Haynes have been selected to fill the vacancies in the A. S. H. & V. E. Research Committee, occasioned by the resignations of W. S. Timmis and H. M. Hart. The two retiring members were the ones who moved and seconded, respectively, the adoption of a proposed resolution at the last annual meeting of the society to abandon the society's Research Laboratory. While acting, as it was generally understood, merely to bring out the sentiment of the members on the proposition, the defeat of the proposed resolution was immediately followed by their resignations from the Committee on Research.

A. S. H. & V. E. Nominating Committee Appointed

The 1924 nominating committee of the A. S. H. & V. E., appointed at a meeting of the council, January 25, is composed of the following: Chairman, J. R. McColl; J. D. Cassell, Roswell Farnham, H. M. Hart and J. C. Hobbs.

New York Chapter Discusses Business and Professional Ethics

How business and professional ethics have developed, especially in recent years, and the profound effect they have had in promoting higher standards in the business and professional world, was brought out in a forceful manner at the March meeting of the New York Chapter, which was held at the Building Trades Club, March 17. The program was arranged by James A. Donnelly and the speakers included Edwin A. Scott, Dr. Rosalia S. Morton and Dr. Henry Neumann.

Edwin A. Scott, publisher of *Sheet Metal Worker*, discussed business ethics as applied to trade and technical journals and traced the development of the present code of ethics to which all members of the Business Publishers' Association, Inc., subscribe. The business press, he said, has long since learned that honesty and fair dealing pays in dollars and cents, as well as in other ways, and that the time has gone by when any line of business can ignore the responsibility of abiding by accepted ethical business standards.

Dr. Morton devoted her talk largely to the ethics of the medical profession and told of the rise of the woman physician and to her maintenance of the same high ethical standards set for the men of her profession. Dr. Morton served in hospital work in Europe during the war and paid a warm tribute to the men in making it possible for women physicians and surgeons to attain their present place in the medical world.

Dr. Henry Neumann showed how ethical standards, while not necessary for some people and of no effect with others, have their greatest application to the large number of people who, while not disposed to depart from the "narrow way," are easily led to do so under the stress of circumstances. He likened such people to that class of automobilists who carefully obey the rules of the road when the traffic officer is on duty but who are prone to break them when no one is watching.

Dr. Neumann spoke especially of the wonderful conception of the purpose of life which was becoming more and more widely accepted and which was placing the emphasis on service to mankind, rather than on the getting of riches. He felt that this ideal was particularly applicable to the heating and ventilating engineer whose work, if properly done, must tend to increase the happiness and comfort and opportunities for better service of other people. He also advanced this idea as the only key to the problem of the so-called social unrest of the day. When those at the top, he said, and those at the bottom of the industrial scale come to feel that there is something else to work for beyond lining their pocketbooks and realize that they are engaged in rendering a service, it will furnish a basis on which they can come together with mutual respect and confidence.

President W. L. Durand announced the death of Frank K. Chew, a former president of the New York Chapter, and, upon his suggestion, a motion was passed authorizing the president to appoint a committee to draw up an appropriate resolution expressing the chapter's sentiments. President Durand appointed as a resolution committee for this purpose A. S. Armagnac, chairman, W. H. Carrier and James A. Donnelly.

Interspersed with the speaking a musical program was carried out under the direction of Miss Helen R. Innis.

Illinois Chapter Discusses Proposed National Heating and Ventilating Code

Features of the proposed heating and ventilating code being compiled by the American Society of Heating and Ventilating Engineers, and especially Section 3 of this code, covering minimum requirements for estimating the heat required for warming buildings, were presented at the March meeting of the Illinois Chapter by Professor A. C. Willard, of the University of Illinois, who is in charge of this section.

Professor Willard emphasized the need for further fundamental research and the study of conditions as encountered by the engineer in practice, to determine more efficient methods and formulas for computation. In this connection he showed, by means of lantern slides, a few types of buildings in which several different methods of computation that are being used could apply with a variance in each, emphasizing further the lack of accurate data. He then submitted several methods of computation for building materials that are more complete than those in general use for the same conditions and materials.

Much of Professor Willard's address was devoted to outdoor temperature records upon which minimum heating requirements, of course, must be based. Considering the importance of wind direction and velocity, he showed how the city of Chicago, for instance, was found to have a prevailing southwest wind over long periods. The discussion, however, following Professor Willard's address, brought out the fact that southwest was not the prevailing wind direction in Chicago during the periods of lowest temperature. This point, said Professor Willard, was well taken and gave further evidence of the need of continued study of the subject.

Before the meeting adjourned the chapter appointed a committee to meet every two weeks in the City Hall to cooperate with the city authorities in working out a proper interpretation of the city's heating and ventilating ordinance. It was announced that the April meeting of the chapter would be addressed by Professor F. E. Giesecke and that his subject would be "Recent Investigations in Hot Water Heating."

New Officers of Cleveland Chapter

New officers of the Cleveland Chapter, elected at the chapter's February meeting, are: President, Ernest Szeckley; vice-president, T. A. Weager; secretary, E. L. Anderson; treasurer, R. E. Bronson. Board of governors: J. J. Mason, M. F. Rather and E. L. Heinle.

Kansas City Chapter Preparing for Society's Summer Meeting

Arrangements are already under way by the Kansas City Chapter for taking care of the American Society of Heating and Ventilating Engineers when it meets in Kansas City next June. John H. Kitchen has been appointed general chairman of the committee on arrangements. This announcement was made by President Gillham at the March meeting of the Chapter, held March 3, at the Kansas City Athletic Club.

In opening the meeting President Gillham reported on the civic activities of the Round Table of Club Presidents of which this chapter is a member. The chapter has been asked to co-operate with the other civic bodies in organizing a Municipal Theatre similar to the one in St. Louis.

Following some further routine business the meeting was turned over to the committee in charge, consisting of L. A. Stephanson, Henry Nottberg and E. A. Cline. Chairman Stephanson introduced

H. S. Frames of Johns-Manville, Inc., who gave a motion picture talk on the manufacture of asbestos, tracing the industry from the mines and mills through the various stages of manufacture to the finished products.

Annual Meeting of British Heating Engineers

A proposal to establish local branches or chapters of the organization in the provincial towns of England was one of the outstanding suggestions made at the annual meeting of the (British) Institution of Heating and Ventilating Engineers, in London, February 11. This suggestion was offered by the new president, P. M. B. Grenville, during the course of his inaugural address.

The principal address at the meeting was delivered by Sir George Croydon Marks, M.P., on the subject of "Inventions and Industries." Sir George referred to the misconception in the popular mind as to what constituted invention as against what was described as discovery, and to the strange confusion of ideas regarding the protection on inventions by letters patent.

For the Research Committee, Chairman Edgar Herring reported that the investigation of heat transmission of standard types of radiators had progressed to the extent originally contemplated, but that it was now proposed to ascertain the transmission coefficient of a radiator partly enclosed, with a top shelf and side cheeks. The committee, he said, hoped later on to study the respective values of radiated and convected heat transmitted by a standard radiator. A complete record of the results of the tests so far carried out on radiator transmission is ready for submission to the council for approval before publication. In connection with the preliminary publication of the tables, Mr. Herring mentioned the fact that the analysis and tabulation of the results of about 300 radiator tests had been undertaken by Alcwyn C. Jones.

For the Boiler Rating Committee, Chairman W. W. Nobbs announced that preparations were pending for recording actual tests. The matter of testing cast-iron structures and safety valves was mentioned by President Grenville who announced the appointment of a committee for that purpose.

It was arranged to hold the summer meeting of the institution in London, June 23, 24 and 25, at the time of the Empire Exhibition at Wembley.

Safety of Vehicular Tunnels

Reports to the effect that the vehicular tunnel in Pittsburgh was not operative because of the amount of gas given off by motor vehicles passing through it have been disproved by an inspection made by representatives of the New York and New Jersey Vehicular Tunnel Commission. When the reports were traced to their source it was found that they arose from the fact that the demand for the Pittsburgh tunnel induced the commission to permit its use for vehicular traffic before the ventilating equipment had been installed.

During the inspection it was found that, on the Sunday previous, a count of traffic showed that 11,000 vehicles passed through this tunnel at a maximum hourly rate of 840 vehicles, yet the maximum percentage of carbon monoxide gas was found to be only 1 part in 10,000, as compared to the 4 parts in 10,000 allowed in the Hudson Vehicular Tunnel plans.

At the same time, the opinion was expressed that this in no way eliminates the necessity of installing mechanical ventilation, as such an installation will give positive assurance of adequate ventilation under the worst conditions. The Pittsburgh tunnel is 5700 ft. from portal to portal, while the Hudson tunnel, between its two portals, will be 8,300 ft.

Significance of the Coal-Economy Shows

operators of doing business is seen by many in the opening of "Coal Economy Shows" in various cities. While heretofore the coal industry has studiously refrained from taking the consumer into its confidence through advertising, the present movement is looked upon as a direct appeal to the consumer. A writer in *Printer's Ink*, Don Gridley, who heads his article, "Another Hard-Boiler Industry Takes Its Case to the Consumer," gives details of the advertising campaign inaugurated by the General Committee of Anthracite Operators which he describes as centering around showrooms in the heart of the shopping districts of Philadelphia, Washington and New York. As he states, in these rooms the operators have built a model colliery so that the consumer may see exactly what happens to coal after it leaves the mine. Several times a day moving pictures are shown which tell the story of anthracite mining. Pictures and posters explaining various items of expense in the mining of coal are prominently displayed.

"Primarily," naively states Mr. Gridley, "the campaign has been conducted to educate the consumer in fuel economy," quite ignoring the fact that the growing surplus of steam coal, due to the wider use of fuel-oil, has created a serious condition in the coal industry which demands quick and drastic action.

At the same time, it's an ill wind that blows no one good and, in this case, the heating industry and the consumers are the beneficiaries. With means available in the form of self-feeding heaters, special grates, magazine-feed boilers for burning buckwheat, rice and even barley, sizes of coal, and with the price of this fuel not more than half the price of the larger sizes of anthracite, a wonderful opportunity undoubtedly is open both to the boiler and grate manufacturer and to the public to cash in on the proposition of cutting down heating costs.

Included in the literature that is being given out at these "Coal-Economy Shows" are some informative pamphlets on "Anthracite—What it is and how to use it and how to buy it," and "How to Cut Down the Cost of Heating Your Home." In the case of the New York show, as already reported in these columns, nine manufacturers of heating equipment have taken advantage of the opportunity to display exhibits of their products.

Heat Transmission Committee Appointed by National Research Council

Members of the heating and ventilating profession have been recognized in the appointment by the National Research Council of a committee to undertake investigations in heat transmission, with a view of furnishing more reliable data for the designing, operating and research engineer. The committee selected, which will act as an executive committee to have general direction of the work, includes F. Paul Anderson, director of the A. S. H. & V. E. Research Laboratory; and Willis H. Carrier, president of the Carrier Engineering Corporation, Newark, N. J.

Others on the committee are: W. L. Badger, professor of chemical engineering, University of Michigan, Ann Arbor, Mich.; Harvey N. Davis, professor of mechanical engineering, Harvard University, Cambridge, Mass.; H. C. Dickinson, chief Division of Heat and Thermometry, Bureau of Standards, Washington, D. C.; H. Harrison, Brunswick-Kroeschell Co., New York; F. E. Mathews, consulting mechanical engineer, Leonia, N. J.; George A. Orrok, consulting engineer, New York; T. S. Taylor, research physicist, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Better Homes Week

Better Homes in America is making elaborate plans for the observance, May 11 to May 18, 1924, of "Better Homes Week." While one of the chief objects of the organization, which is an educational, non-commercial corporation, is to help the man of small means learn how to own his home, much of its work is directed also to aiding small home-owners to improve their living conditions.

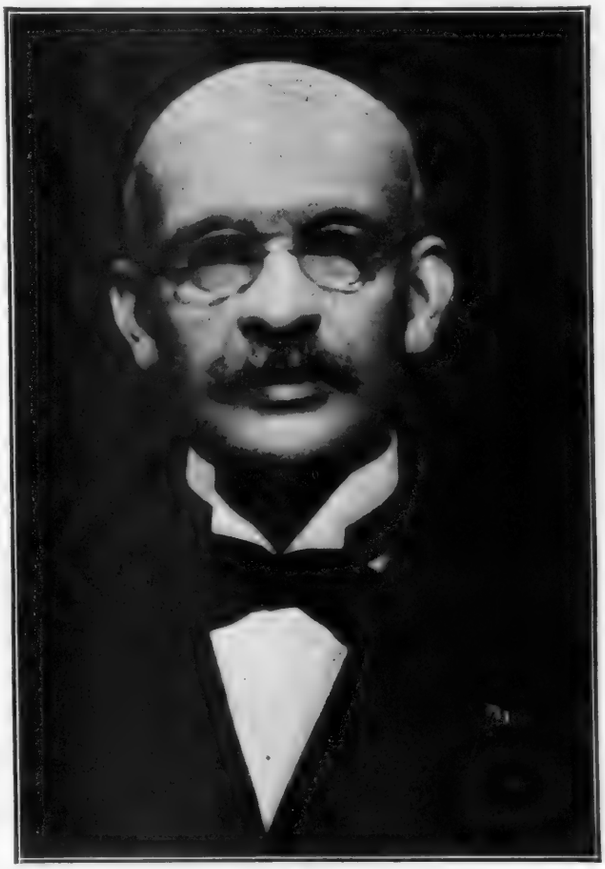
Thus the organization is trying to educate home owners into improved methods of heating and ventilation and similar conveniences of the age.

A New Plumbing and Heating Journal

Another journal has been added to the ranks of those devoted to the plumbing and heating fields. It bears the title of *The National Plumbing and Heating News*, and the journal's staff includes John J. Simcox, managing editor, formerly of the *Plumbers' Trade Journal;* Frank R. Lawlor, technical editor; William B. Lawler, advertising department; and George J. Fleck, circulation department, formerly with the *Plumbers' Trade Journal.* The first number, issued March 15, 1924, makes a creditable appearance and gives a very good idea of the scope of its activities, covering the interests of "the busy manufacturer, jobber, master plumber and heating contractor." *The National Plumbing and Heating News* is of standard magazine size, 9 x 12 in. and the first number contains 36 pages.

Death of Frank K. Chew

Frank K. Chew, editor of *Sheet Metal Worker* since 1920 and, previous to that, editor of *The Metal Worker* for nearly a full generation, from 1892 to 1920, died at the home of his brother in Morristown, N. J., March 8. The end came just seven months and one day after he was stricken with an illness which was diagnosed as heart trouble. He was taken at first to the New York Hospital where he remained four weeks. At the end of that period he had gained sufficient strength to be taken to Morristown.



Frank K. Chew

Although evidences of a losing struggle were to be noted some time before the end, it was a consolation to his friends to know that his illness was not accompanied by pain, even when the final call came. Heart action simply ceased.

As an outstanding and influential figure in both the warm-air furnace industry and the heating and ventilating industry, Mr. Chew was one of the best-known men of his time. Especially in the formative years. Mr. Chew's constructive ideas played a large part in shaping the development of both industries. The circle of his acquaintances constantly expanded until it became as wide as the country itself. At any gathering of heating men in any section of the country, when Frank Chew rose to speak, usually with his pencil poised, there was always a sign of recognition and the anticipation of hearing something worth while. Needless to say, this anticipation was generally realized.

Few of Mr. Chew's friends knew, however that he was 66 years old when he died. So jovial was his nature, so boyish his enthusiasm and so active his spirit that he seemed to be only in the prime of life. He was born in Salem, N. J., in 1858. His first work, in 1875, was in a shop engaged in heating, plumbing and sheet-metal work. Later he was associated with the Abram Cox Stove Company. For a few months in 1892 he was an assistant to the Philadelphia representative of *The Metal Worker*. Then, after a short interruption of this service, he joined the editorial staff of *The Metal Worker*, New York. There he remained continuously from 1892 to 1920, serving most of that period as editor.

It was during these years that Mr. Chew made the great place for himself which will always be associated with his name. Both in the columns of *The Metal Worker* and on the convention floor, he became known as an aggressive fighter for what he deemed to be for the best interests of the industry and the soundness of his ideas were many times exemplified in the adoption of the measures he advocated. Particularly in the American Society of Heating and Ventilating Engineers, of which he was one of the early members, Mr. Chew left his impress, while the fact that he was an honorary member of the National Association of Sheet Metal Contractors and of the National Warm Air Heating and Ventilating Association, bears witness of the prominent part he played in the development and activities of those two organizations.

When the Edwin A. Scott Publishing Company was organized, in August, 1920, and the amalgamation of *The Metal Worker* with *Sheet Metal* was brought about, under the name of *Sheet Metal Worker*, Mr. Chew became vice-president and a director in the company and shared with Edwin A. Scott the editorial duties on *Sheet Metal Worker*. Although his work was largely confined to this journal, he also took an active interest in *Sanitary and Heating Engineering* which was started by the Edwin A. Scott Company, at the time of the amalgamation, to take over the heating interests which had formerly been covered by *The Metal Worker*.

Mr. Chew's friends can well echo the estimate of him contributed by his associates in *Sheet Metal Worker*, in the statement that "to have known him as a man was a privilege enjoyed by many; to have been associated with him in any of his work was an inspiration. When it was a question of right he knew neither fear nor compromise, and his own personal advantage was next beyond the last consideration."

Mr. Chew was active in many organizations, in addition to those already mentioned. One of these was the American Society of Sanitary Engineers. He was a past president of the New York Chapter of the A. S. H. & V. E. and served as a member of the board of governors of the A. S. H. & V. E. in 1906, 1907 and 1908. He was a member of Trimble Lodge, F. and A. M., Damascus Commandery Knights Templar, and Salaam Temple, A. A. O. N. Mystic Shrine.

He is survived by an only son, Frank W., who is a student at the University of Kentucky. Mrs. Chew, who was Lena M. Walker, before their marriage in 1895, died in 1919. Mr. Chew also leaves two brothers and three sisters.

Among the tributes to Mr. Chew, one from George W. Cope, a former member of the editorial staff of *The Metal Worker*, gives a striking picture of Mr. Chew's personality:

"Endowed with keen initiative powers, he was in the forefront of every movement to advance sheet-metal interests. It was his pleasure to bring forward new ideas in presenting the advantages of sheet-metal as a fire-proof and durable covering for buildings. Old as is the history of the application of sheet-metal to this purpose, its use has been stimulated by his vigorous educational efforts in this direction.

"Mr. Chew had an endearing personality. He was a ready speaker, quick at repartee, and his quaintly original metaphors never failed to win for him

an appreciative hearing. Few men have had a wider circle of friends, and his passing truly leaves an aching void."

Another notable tribute is offered by W. W. Macon, who was formerly associated with Mr. Chew as editor of *The Metal Worker* and who is now managing editor of the *Iron Age*. "Many—legion, in fact," declares Mr. Macon, "are they who can admit responding to the stimulus of his often spectacular argument and urging and who have profited by practical suggestions given without hint of restriction. His sterling character, his always evident honesty of purpose, his obviously unselfish devotion to his calling, his liking for honesty, industry and trustworthiness in others—these all gained for him friends in every walk of life.

"The passing of a man who has achieved distinction above the common level emphasizes the melancholy fact that his identity as a mortal is soon swallowed up in the continuing activity of the crowd, but it also emphasizes the other fact that his influence goes on for long and his contributions to social, commercial and technological progress are lasting helps to those who take up his tasks.

"Imagine a man of virile direct statement in figures of Anglo-Saxon speech of his own making and you have Frank Chew. Frank like his name, he took a position without reservation and trusted to resourcefulness of mind and speech to worst the adversary, matching open deploying of his army against the one who might fight under cover of argumentative points held in reserve. His co-workers will agree that they needed to be well fortified with facts if they wished to swerve Chew from paths he thought straight. As one of them for some six years, the undersigned proved this time and again.

"It was almost an obsession with Chew to appraise all mankind in terms of honesty, but in his own success in measuring to his ideal, he was not like many others, constantly advertising his own straightforwardness. The most he would say perhaps was, 'It pays to be decent.'

"In his rational basis of analysis of men and things, he was greatly helpful to his fellow workers. For such help and the encouragement which went with it, the man Frank Chew means more than is here expressed to one who enjoyed with him the pleasant years of the joint editorship of *The Metal Worker*, from 1905 to 1911."

Deaths

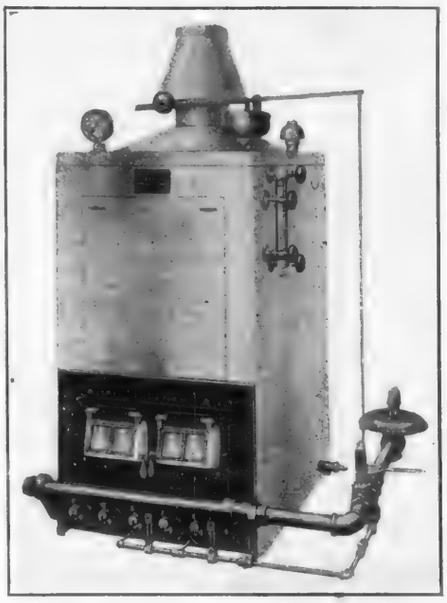
JEREMIAH SHEEHAN, president of the J. Sheehan Plumbing Co., St. Louis, Mo., and the oldest living past president of the National Association of Master Plumbers, died February 29, at his home in St. Louis. Heart trouble, from which he had suffered at intervals for several years, caused his death. He spent practically all of his last day at his desk, the fatal attack striking him after dinner at his home in the evening. He was born in 1849 in Ireland. A widow, five sons and two daughters survive.

New Apparatus and Appliances

Development of New Gas-Fired Boiler

An interesting and improved type of gas-fired boiler, with a polished aluminum jacket, has just been placed on the market through the A. H. Wolff Radiator Co., New York. It is a product of the American Radiator Company, and is known as the Ideal gas boiler, Type 3-G, designed for steam, vapor and water heating systems, domestic hot water supply and for general industrial purposes.

Efficiency tests show that between 86% and 87% of the gross heat value of the gas is utilized. On this basis the efficiencies would exceed those possible with any coal or oil-burning boiler.



New Type 3-G Ideal Gas Boiler

The aluminum jacket is provided with a thick air-cell asbestos lining, forming an effective heat insulator. The polished aluminum surface, it is pointed out, can be easily cleaned, is pleasing in appearance and is not subject to corrosion. The advantage of this type of jacket is that it can be easily removed and replaced at any time, as well as forming a permanent and durable covering for the boiler.

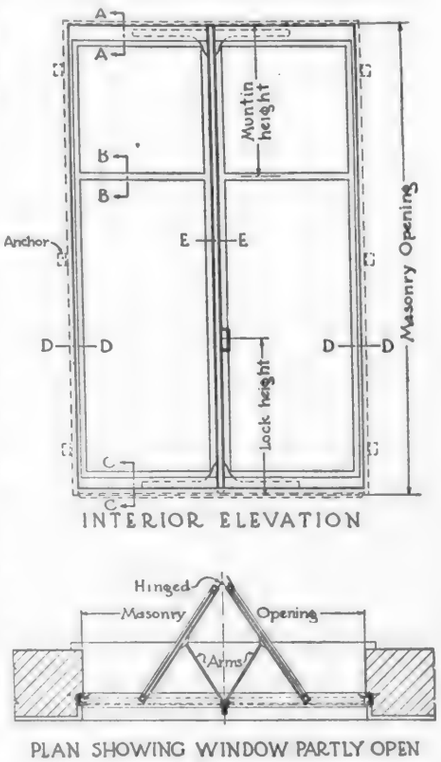
The hot gases from the burners in this new boiler flow directly upward at a high velocity between the water-backed walls of the sections. A staggered arrangement of extended pins on each section is designed to force these gases to pass in fine streams over all the heat-absorbing surfaces. By the time they reach the top of the boiler and are ready to pass into the flue connection, the heat has been absorbed to the extent stated, thus giving a large production of heat with a minimum consumption of gas. Care has been taken in the arrangement of the sections and heating surface to make every part of the boiler coming in contact with the products of combustion readily accessible for inspection or cleaning.

The efficiency and capacity of the burner, the manufacturer states, has been greatly improved by the new Venturi mixing tube, which is designed according to specifications of the U. S. Bureau of Standards.

While this new boiler is offered as the main heating unit in a given installation, its use is also recommended as an auxiliary to a coal-burning boiler, for operation during periods when it is desired to bring up the house temperature quickly on cold mornings, or during mild weather when only a little heat is needed.

A Window Designed to Stop Air Leakage

An interesting type of window which has been designed to stop air leakage, as well as to be fireproof, weatherproof and dustproof, is being called to the attention of the heating trade by Richey, Browne & Donald, Inc., Maspeth, New York City. It is known as the Browne window and is made of solid rolled steel. The Browne window is on the order of the casement type. There are, however, no hinges. Instead, the window is supported by hinged arms attached to a verticle bar. The accompanying illustrations

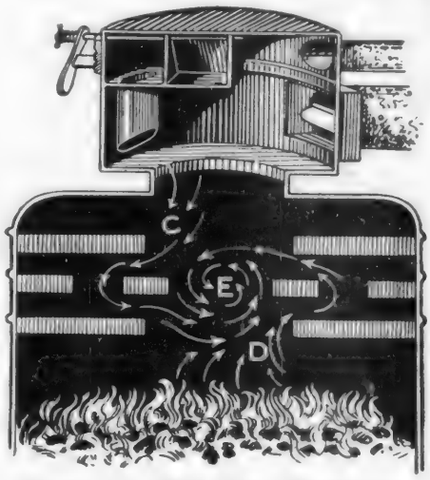


Design of Fireproof, Weatherproof and Dustproof Window

show the window closed and open. When in a closed position, the sides as well as the center opening, rest against felt cushions, making, it is stated, an air-tight and dust proof unit. For this reason the window has been found especially adaptable for high buildings.

The Clark Fuel Economizer

A device intended to be attached to any type of domestic heater and designed to bring the "runaway" gases back to the flames, mixing them properly with air and producing the right heat in the flues, has been developed by W. G. Borland, 5726 Sherbrooke St., W., Montreal, Canada. It



Design of Clark Fuel Economizer

is known as the Clark fuel economizer. As shown in the accompanying illustration, the device admits air at the top of the combustion chamber. As it passes down at one side through baffles which heat it, it meets the rising gas fumes which are ignited close to the dome of the fire-pot. Tests of the device made at McGill University are reported, showing a fuel saving of 19.5%.

The Buffalo Unit Heater

As was announced in last month's issue, one of the latest types of unit heaters

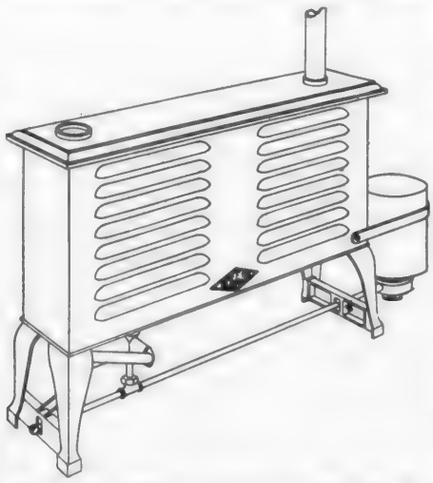
Typical Installation of Buffalo Unit Heater, With Aerofin Copper Heater

Double Outlet Arrangement of Buffalo Unit Heater

to utilize copper and brass radiation is the Buffalo unit heater, brought out by the Buffalo Forge Co., Buffalo, N. Y. The two typical installations here shown of this heater are those made in the East Pittsburgh Works of the Westinghouse Electric & Mfg. Company. In each view a glimpse may be had of the Aerofin radiator, of brass or copper, with its helical extended surface.

A Portable Unit Oil-Fired Radiator

From Chicago comes an idea for a portable unit oil-fired heater, shown in the accompanying illustration. It has been designed by J. L. Breese, Jr., of the Breese Engineering Corporation, 341 East Ohio St., Chicago, manufacturer of the Breese "Burnoil" house-



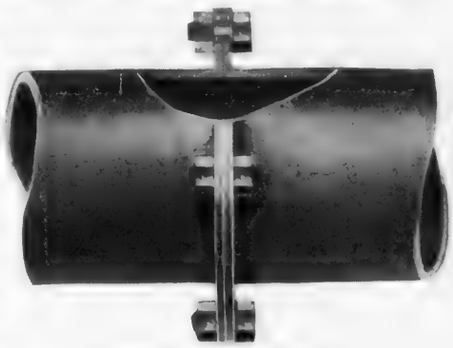
Burnoil Filling Station Oil-Fired Heater

heating boiler. The unit is composed of a radiator made of steel tubes, to which is connected a small oil burner. Radiator, burner and fuel-storage tank are combined in a compact unit. With its sheet-iron removed, the unit looks like a small gate, being built of two upright and five horizontal pipes. Although the result of two years' work, Mr. Breese states that it was only within the last three months that he discovered a means of making the combustion silent and avoiding the formation of carbon on the vaporizing device. The radiator proper is about 2 ft. square. It burns between one and two pints of distillate per hour. The burner operates on 3 lbs. pressure so that the use of the heater is confined for the present to automobile service stations and similar buildings where air pressures are carried for inflating tires. The air is piped through a pressure-reducing valve with which each machine is equipped.

Mr. Breese, it may be added, is not as well known as a combustion engineer as he is as an aviator. In the Spring of 1919 he was the engineer on board the NC-R which made the first flight across the Atlantic from Rockaway, L. I., New York, to Plymouth, England.

Lap Joints for Piping

One of the exhibits at the recent New York Power Show was a Ballwood lap joint, shown in the accompanying illustration. This joint, it will be noticed, is an integral part of the pipe. The flange or lap, after machining, is substantially of the same thickness as the wall of the pipe. Laps are avoided with



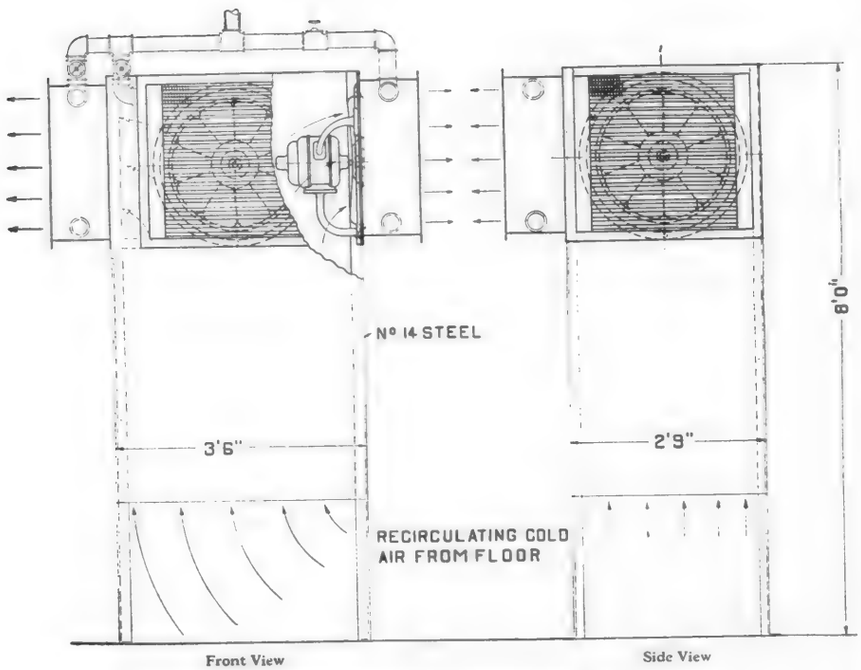
Ballwood Lap Joint

square corners so that the metal at the bend is somewhat thicker than the wall of the pipe. Bolt holes are drilled in the lap, of requisite diameter and number in proportion to the pipe itself. The joint is described as well adapted to low-pressure or exhaust lines and less expansive than a flanged joint, as well as cheaper to erect. The manufacturer is the Ballwood Co., 30 Church St., New York.

The Venturafin

Designed especially for application where lightness and high efficiency are the paramount considerations, the Venturafin has been developed by the American Blower Company, Detroit, Mich., for the heating of industrial buildings, warehouses, etc. It is described as the most compact heating apparatus ever developed. This is made possible by the design of the heating surface which is made from copper and brass in the form of steam coils. Each square foot of heating surface has been found capable of radiating five times the heat that can be given off by a cast-iron heating surface of the same inside dimensions.

Venturafin tubes are of the Aerofin type, made up of straight, seamless copper and brass tubing, about which

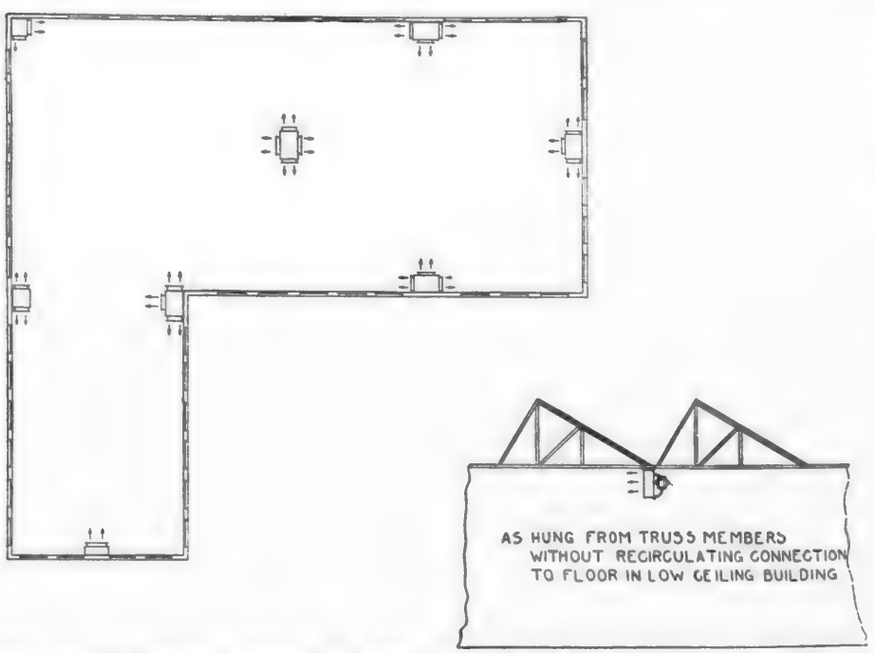


Three-Unit Arrangement of Venturafin Unit Heater

is helically wound a copper ribbon in such a way as to form a continuous "fin." The tubes are arranged in rows, usually three deep and staggered. The ends of the tubes are pressed into a thin, flexible copper plate, the holes in which are slightly smaller than the tubes. This gives a tight flanged connection. The flanges are later given a solder bath to render the connection doubly secure. The flexibility of the plate is depended upon to take care of expansion and contraction.

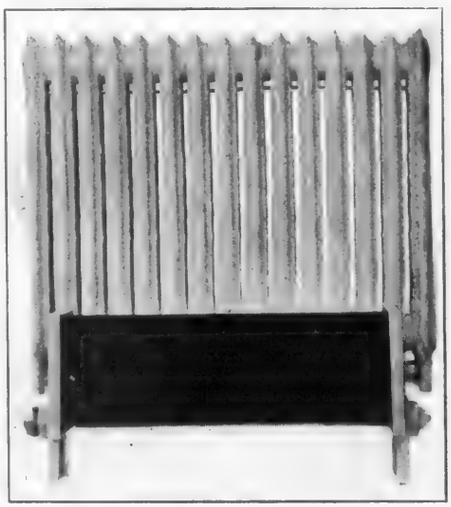
Semi-cylindrical die-pressed headers are then placed over the ends of the tubes and locked on by means of a folded seam construction. The headers are provided with the same connections.

Standard Venturafin heaters are built to withstand a pressure of 50 lbs. steam or liquid, or any vacuum. Each Venturafin section includes a standard motor-driven Ventura fan as an integral part of its construction. The accompanying plan shows typical applications of Venturafin heaters to various parts of a factory or any similar building. They are described as particularly well adapted for use in irregularly-shaped rooms or for localized heating near doors frequently opened or where only a part of a large room is to be heated. Each point where air discharge is shown indicates a separate unit, each having a capacity of about 3000 cu. ft., heated from 60° F. to 115° F., with steam at 5 lbs. pressure, corresponding to 150,000 B. T. U. per hour.



Methods of Adapting Venturafin Unit Heaters for the Warming of Factories and Other Large Areas

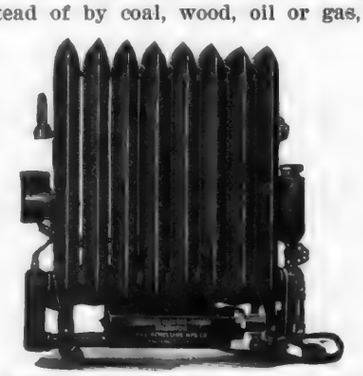
SAGE RADIATOR; a new idea in gas heating apparatus, is featured in an interesting folder issued by the Sage Radiator Co., Inc., Syracuse, N. Y. This radiator is described as occupying about one-ninth of the space and weighing one-fifteenth as much as a cast-iron radiator of the same capacity. Two illustrations of the new radiator are shown in the folder, one depicting its small size in comparison with the old-style cast-iron radiator and the other a Sage radiator, with cover, comprising 70 sq. ft. radiation. The folder states that the small size, coupled with large capacity offers advantages for in-



Sage Brass Radiator Compared in Size With Cast-Iron Radiator

stallation in homes, apartment houses, office buildings and steamships. Another feature which is emphasized by the manufacturer is the method of heating. The Sage radiator, it is explained, takes the air from the back, passes it through its interior and discharges it at the front, thus preventing it from rising along the walls and depositing dirt. The greatest advantage, however, claimed for the new radiator is its ability for rapid heating. This is explained by the fact that the radiator contains a comparatively small amount of water. The new radiator is constructed entirely of brass, and the radiating body is seamless. Other Sage products mentioned in the folder include an automobile radiator, hot water heater, and garage heater.

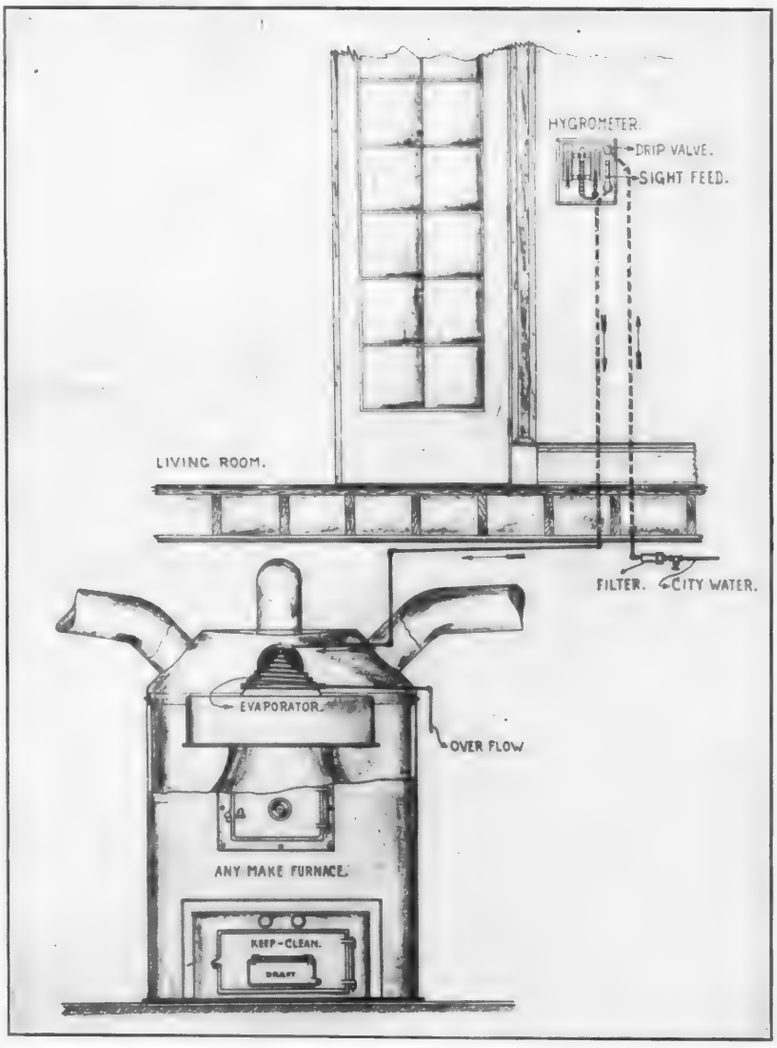
HULBERT ELECTRO-STEAM RADIATOR, in which steam is generated by electricity, instead of by coal, wood, oil or gas, is



Hulbert Electro-Steam Radiator

an interesting product brought out on the Pacific coast by the Scheeline Mfg. Co., 76 Tehama St., San Francisco, Cal. Each

Hulbert radiator, it is pointed out, is a separate unit, and is mounted on casters so as to be readily movable. The soul of the radiator is an automatic device which is arranged to control the pressure by cutting out the greater part of the current whenever the required steam pressure of 10 lbs. is reached. When the pressure is lowered through condensation, the control again switches on enough current to raise the steam pressure to 10 lbs. In this way just enough electricity may be used to keep the pressure up to 10 lbs., resulting in corresponding economy. The control, it is added, is a positive pressure-operated device, and not a thermostat. The manufacturer explains that with the exception of the bathroom heater, none of the Hulbert electric radiators should be attached to the lamp socket, but should have a separate wire capable of carrying the necessary current in amperes for one or more radiators without impairing the efficiency of the radiators. Hulbert electro-steam radiators are made in a variety of types and sizes, all of which are listed in the company's catalogue, together with the average current consumption in kilowatt-hours for an 8-hour run.



New Type of Humidifier for Use with Warm-Air Furnace

Novel Type of Humidifier for Warm-Air Furnace

Something new in the way of a warm-air furnace humidifier has been developed by H. M. Nobis, heating and ventilating engineer, 2036 East 105th Street, Cleveland, O., and is shown in the accompanying illustration. It will be noticed that in addition to providing for an automatic renewal of the water supply as it becomes exhausted, the device is also supplied with a hygrometer by which the amount of evaporation may be regulated according to the needs.

New Power Test and Safety Codes

TEST CODE FOR HYDRAULIC POWER PLANTS AND THEIR EQUIPMENT and SAFETY CODE FOR MECHANICAL POWER-TRANSMISSION APPARATUS, the latter containing rules for guarding prime movers, intermediate equipment and driven machines, have been published. The rules embodied in the "Safety Code for Mechanical Power-Transmission Apparatus" have been approved by the American Engineering Standards Committee as a Tentative American Standard. They will be of special interest to those having to do with prime movers, mechanical power transmission equipment, starting and stopping devices, guard standards and operating rules. Copies of these codes may be obtained from the American Society of Mechanical Engineers, 29 West 39th Street, New York.

AMERICAN RADIATOR COMPANY'S thirty-second annual report for the year ended December 31, 1923, which has just been published, shows total net profits of the American companies of $9,168,017 and, of the European companies, $1,800,959, or $10,968,977 in all. In a statement included in the report by Clarence M. Woolley, chairman of the board, it is pointed out that the volume of business transacted by the company during 1923 was in excess of any previous record. Sales, including those of all subsidiaries at home and abroad, aggregated $78,696,713. As these sales represent a rate of increase largely in excess of the rate of increase in building activity, they are considered as further evidence of the growing popularity of steam and water heating.

Due to difficulties experienced in the early part of 1923 in obtaining adequate supplies of pig iron, the company purchased for cash the business and property of the Tonawanda Iron & Steel Corporation, at North Tonawanda, N. Y., which, it is stated, insures a supply of iron for the plants in the Buffalo district. Substantial improvements, nearly completed, will enable the company to produce at advantageous cost a grade of pig iron peculiarly adapted to its special requirements.

Another item of special interest in the report is in connection with the company's increased business in Canada. To meet the demand for greater manufacturing capacity, the American Radiator Company of Canada, Ltd., entirely owned by the American Radiator Company, purchased the business and property of the Dominion Radiator Company, Ltd., of Toronto.

National Warm Air Heating and Ventilating Association will hold its eleventh annual convention in Cleveland, O., April 16-17, 1924. Headquarters will be at the Hotel Winton. Among the interesting reports scheduled are those of the Committee on Educational Publicity and Trade Extension, John P. Wagner, chairman; Special Committee on Trade Extension, E. F. Glore, chairman; and the Simplification Committee, R. C. Cook, chairman. The papers to be presented include one on "Education and Its Relation to Better Heating," by A. M. Daniels, of Washington; one on "The Association Research Work at the University of Illinois," comprised of reports of the Advisory Committee, C. M. Lyman, chairman, and the report of Director A. C. Willard and his associates; and one on "The Use of Ozone in Residence Heating," by E. S. Hallett, St. Louis, Mo.

Condition Is Normal

Market Retains Healthy Aspect—Industry Optimistic

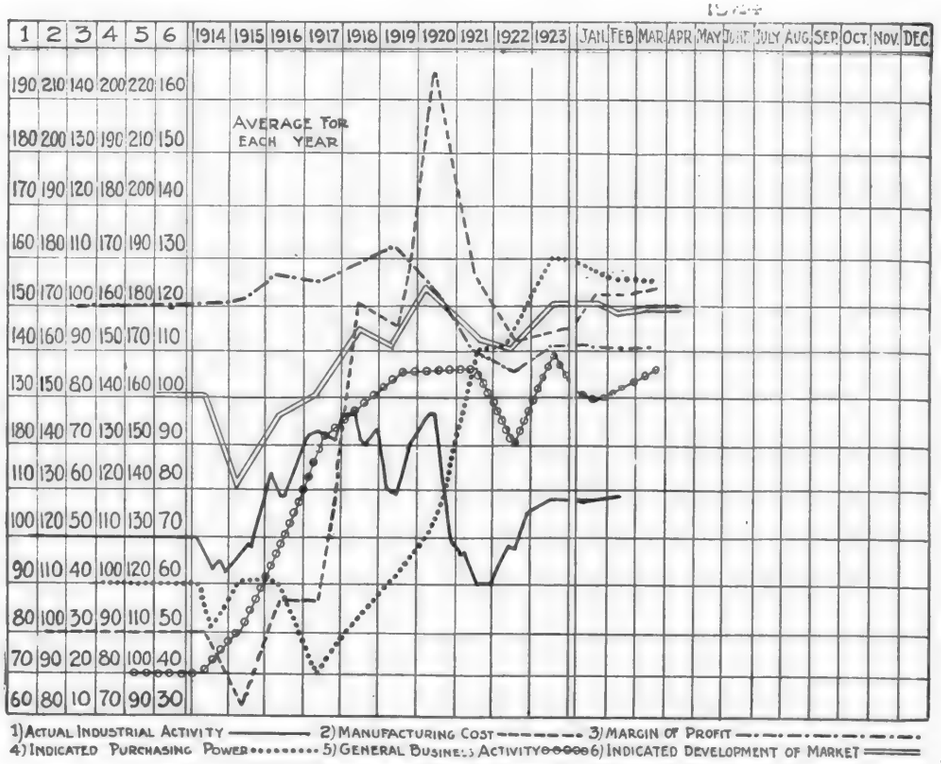
Especially Prepared for THE HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn-Schmidt

MARKET conditions cannot be judged correctly by the performance of any separate industry, but only by a survey of all the factors making for prosperity or depression. If we fail to apply this rule we are bound to meet disaster, as evidenced by the sudden financial depression in February. This was indicated, however, correctly by our chart, as may be seen by examining the sudden downward bend of the prosperity line during February.

March in the meantime has brought the expected recovery but reports from most market centers characterize the situation still as "streaky." This might have been expected, considering the general unsettledness of the market around tax-paying time, underlined this year still more by the expectancy of changes in the tax laws. With tax payments out of the way and considerable savings ahead of the tax payer the recovery cannot be held back much longer. It is heralded already by the double line of the chart showing renewedly the remarkable steadiness which has been its leading characteristic during the second half of 1923.

Market experts now agree that the danger of a decline is almost past. But their judgment also seems to be unanimous as regards the unlikelihood of any marked rise in the immediate future. This conservative opinion of the outlook is justified by actual conditions. The present situation is holding many contradictory elements. While indications in one direction (as, for instance, in the steel industry) point to a very considerable growth of the volume of business, there are other similar valuable indicators exerting a decisive downward pressure and preventing the economic curve to take a clearly-defined upward movement.



Analysis of Business Conditions at End of March

In such a situation the manufacturer, desirous of getting some hint on the likely course of the market, does well to take counsel of the fundamentals of the market structure. These for his own specific field are: the cost of raw materials, labor and overhead, making his own manufacturing cost, and the selling price of the manufactured product with the resulting margin of profit. Let him imagine this enquiry, repeated over the multitude of industrial enterprises of the United States, and he will realize why cost of manufacturing and the manufacturer's profit margin are important factors for the wellbeing of the national markets.

If manufacturing costs rises rapidly in the face of heavy competition, amounting to overproduction, and when, in consequence, prices decline, there follows a decline in the profit margin of the national industry. This, in turn, means a weakening of the purchasing power of the industry, resulting in a decline in the purchase of materials, the purchase price of labor and the manufacturer's spending.

Expectation for larger orders has caused a revival of industrial activity and a greater demand for labor. This brought a small rise in wages and a similar limited rise in the cost of many leading raw materials. Both, however, are not large enough to weaken materially the industrial profit margin. They have been accomplished by a correlated rise in cost of the industrial product. So industry is operating on a healthy basis, although profits are still below the averages of ten years ago and certainly very much below the high tide of 1919.

If manufacturers are optomistic and inclined to produce more rapidly, they have in support of their theory the fact that the purchasing power of the nation remains very satisfactory. But it must be pointed out in this respect that the margin to be spent, above the indispensable needs of the wage earner and salaried man, no longer as high as it has been

during the previous year. It has shown a steady decline since the beginning of the present year.

There has been a readjustment of the situation disclosing a certain weakness of the market. This was quickly eliminated and is now followed by a new flattening-out movement upon a level just slightly below that of last year with business marking time, waiting for a new cue.

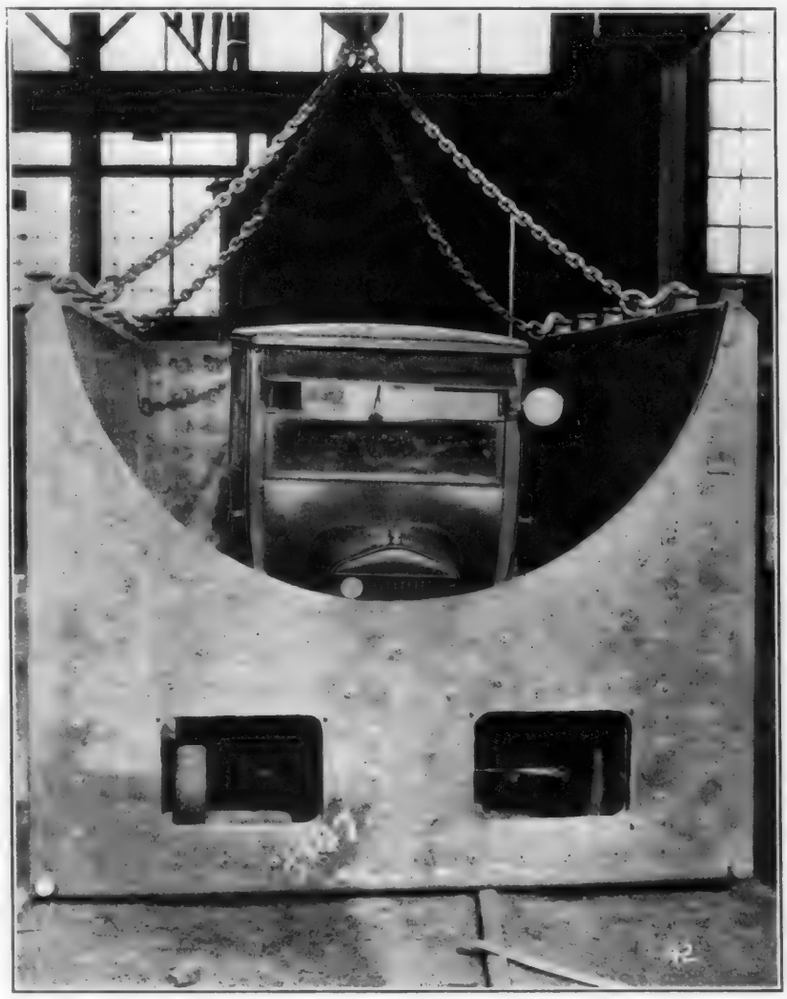
What is now the likely outcome of this condition? An answer to this question cannot be found by applying past experiences, because the history of American commerce does not seem to present any similar condition where the market has remained firmly established on the crest of an economic wave for almost three quarters of one year. One might almost expect that the very length of the period must hide somewhere a sudden turn to the better or the worse. Nevertheless, by taking into consideration all the factors pointed out, the stability of industrial production cost and earnings, the steadiness or national purchasing power and the healthy state of business in all branches, one is inclined to give this state of balance another three months, completing the circle of one year. This is the more likely as the present condition is absolutely healthy and shows no indication of underlying weakness.

It is not caused by any inertia or lack of enterprise. On the contrary, manufacturers and jobbers all over the country report a regular flow of orders and credit situation has improved very much during the first months of the year. Orders are numerous and in this way compensate in a manner for lack of quantity of the individual shipment. Merchants do not retrench, but they have adopted a system of quick turnover, eliminating in this manner the danger of overstocking which made the economic depression so dangerous during the second half of 1914. There are manufacturers who are inclined to describe the market as "quiet." This description is wrong. It should rather be called "normal and befitting the size of the American market of today."

Boiler Requirements for a Modern Building

An idea of the type of boilers used in many of our large commercial buildings is given in the accompanying illustrations. The boiler shown on the flat car is a No. 629-C Pacific smokeless boiler, with a rated capacity of 20,000 sq. ft. of steam radiation. It is one of two boilers recently built by the General Boilers Company for use in the Lowenstein Building, Memphis, Tenn., Hanker and Cairns, architects, and Thomas H. Allen, engineer. The boilers are being installed by the Hughes Heating Company, of Memphis. The second illustration gives an idea of the size of these boilers. The photograph shows one of the fireboxes, inside of which has been placed a Ford Coupe.

One of Two Pacific Smokeless Boilers Installed in Lowenstein Building, Memphis, Tenn.



Ford Sedan Car Placed in Firebox of Pacific Boiler for Lowenstein Building, Memphis, to Show Size of Boiler

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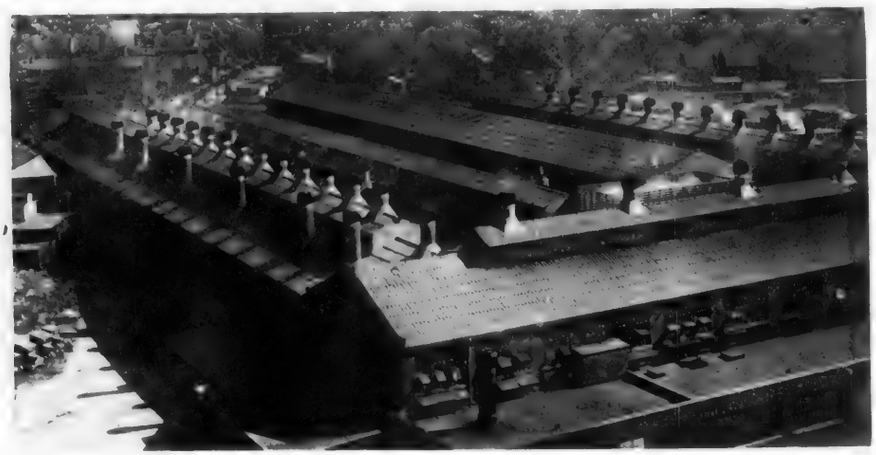
WEBSTER FROM THE AIR is the title of an attractive booklet received from Warren Webster & Co., Camden, N. J. The book is novel in that it is almost entirely illustrated with aerial views of various cities, including San Francisco, Seattle, Baltimore, Philadelphia, Detroit, Cincinnati, and a dozen others, where Webster systems are in use. This company announces also in an attractive bulletin, the addition of the Webster boiler return trap to its line of Webster modulation systems of steam heating. The new product, it is stated, is adventageous under many conditions, among them being (1) where excessive pressure is rapidly generated: (2) where it is necessary to maintain a higher steam pressure for a part of the time (3) where it is desirable to design the piping system for a continuous operating steam pressure ranging from 2 lbs. to occasional pressures of 10 lbs.; (4) where a large part of heated radiation may be cut out. Size 6 x 9 in. Pp. 32 and cover.

CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa., announces special summer courses in heating and plumbing to be given this year at its Summer School. The courses will begin June 16 and June 30 and will continue six and eight weeks, respectively. Special emphasis, says the announcement, will be placed upon the advanced courses in heating and plumbing that have been arranged especially for beginners in the contracting business. Special courses for the trade will also be given in workmanship and various types of installation. Inspection trips to the Pittsburgh district factories of pipe manufacturers and heating and plumbing equipment will be a regular feature of the work. Other summer courses offered by the Carnegie Institute of Technology include those in mechanical drafting, machine shop practice, chemistry, physics, mechanics, engineering drawing and coal mining.

Efficiency of Automatic Ventilators in Removing Smoke and Fumes

A remarkable accomplishment with automatic ventilators is reported by the Allen Air-Turbine Ventilator Co., Detroit, Mich., in connection with the removal of smoke and fume conditions in the plant of the Mather Spring Co., of Toledo, O. This plant was experiencing what was described as one of the most, if not the most aggravating condition, in this respect, to be found in a major industrial concern.



Installation of Forty-three 48-in. Allen Air Turbine Ventilators at Plant of Mather Spring Co., Toledo, Ohio

The trouble, which has now been corrected, arose in the fabricating unit of the Mather Spring Company. This building is 400 ft. long and 260 ft. wide. Due to the tremendous volume of business handled, the equipment included 46 furnaces, fires and chemical baths, in addition to a large number of oil-quenching baths, all of which produced a tremendous volume of smoke and fumes which were so thick that one was not able to discern the features of a person standing at a distance of more than 20 ft.

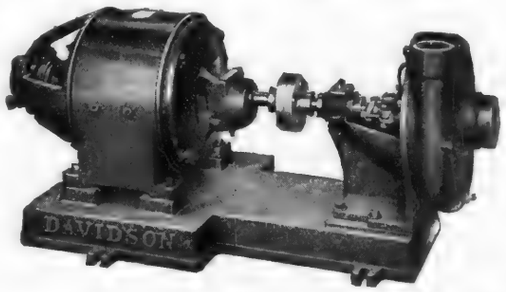
After considering various ventilating schemes, the plan proposed by the engineers of the Allen Air-Turbine Company was accepted, involving the installation of turbine ventilators. A contract was awarded to the Luzius Bros. Co., of Toledo, covering the installation of forty-three 48-in. Allen air-turbine ventilators.

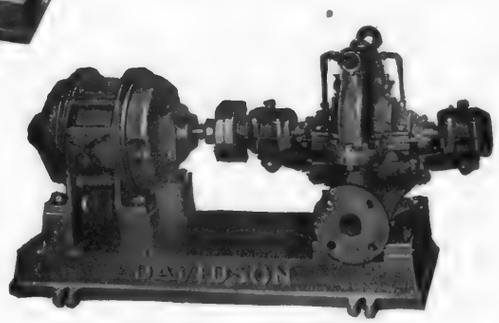
The extent to which the company's ventilating troubles were overcome by this means is indicated in the statement by G. M. Mather, president of the Mather Spring Company, that "the installation has been very satisfactory as a remover of the smoke and gases from which we suffered." "Further," he added, "they add much to the appearance of our buildings."

New Trade Publications

TRANE VACUUM PUMPS are featured in Bulletin No. 4, recently issued by the Trane Co., LaCrosse, Wis. Prominence is given in the new catalog to the two-motor Trane return-line vacuum pump, and attention is called to the fact that the company now is prepared to quote on sizes having capacities up to and including 75,000 sq. ft. for 60-day delivery. Two standard types of return-line vacuum pumps are presented: those having the air pump and the water pump in one casing, and those having them in separate casings, but also driven by one motor. A description is given also of the Two-Motor Special. Each pump has its own motor and there is no connection between the two. Other pumps in the new bulletin include Trane centrifugal water pumps and Trane air line pumps.

DAVIDSON CENTRIFUGAL PUMPS, of the single-stage, single suction volute type, with electric motor drive, and of the single-stage double-suction volute type, also electric-motor drive, are brought to the attention of the trade in recently issued circulars published by the manufacturer, the M. T. Davidson Co., 154 Nassau St., New York. This company has been pump builders for nearly fifty years, being the manufacturers of the well-known Davidson line of steam pumps. To these the company has now added its line of centrifugal pumps which are described as conforming to the same high standards. The bulletins referred to have been combined with the regular catalog of Davidson steam pumps in a convenient loose-leaf form, accompanied by numerous tables and other useful pump data.





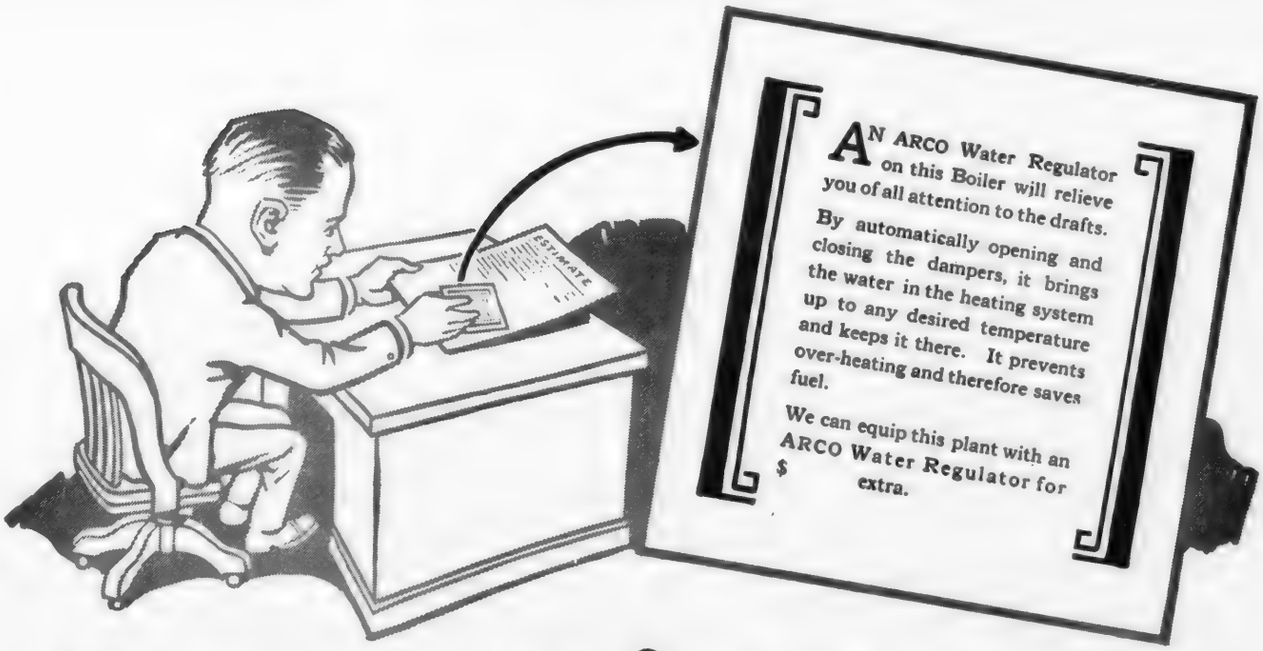
(Above) New Davidson Single-Stage, Single Suction Volute Pump, with Electric Motor Drive. (At right). New Double-Suction Pump, Volute Type.

GOLD'S HEATING SYSTEMS for railway cars and locomotives, and ventilators, are featured in a new catalogue (No. 24) received from the Gold Car Heating & Lighting Co., 220 36th Street, Brooklyn, N. Y. In addition to the car heating equipment, the catalogue shows how some of the company's products, such as the Gold thermostat, and Gold electric magnet radiator valve may be used to advantage in house-heating work. Size 4 x 6 ½ in. Pp. 236.

GURNEY BOILERS AND RADIATORS are described and illustrated in a new catalog (No. 36) published by the Gurney Heater Mfg., Co., Boston, Mass. The catalog cites the Gurney down-draft smoke-consuming boilers as a type embodying all the well-known and desirable features of the Gurney Bright Idea water-tube construction, with the addition of a water-tube grate and down draft principle, which makes them practical as a smoke-consuming type. This type is designed particularly for burning soft coal. The catalog enumerates all the well-known types of boilers manufactured by the company and presents also its line of radiators, ventilating equipment and specialties. The book is attractively compiled and contains 128 pages and the cover. Size 4½ x 6½ in.

FOXBORO IMPROVED HELICAL TUBE MOVEMENT is presented in a new circular of the Foxboro Co., Inc., Foxboro, Mass. The company announces that its engineers have overcome the so-called "necessary evils" of recording instrument construction and have produced one that is "permanent in calibration and which does not weaken in service." The improvement was effected, it is stated, by doing away with adjustments at certain points.

JOHN C. WILLIAMS, head of John C. Williams, Inc., New York, heating contractors, a member of Heating and Piping Contractors' New York City Association, died February 6, at his home in Bayshore, L. I. He was 45 years old. He is survived by a widow and four children. His business will be liquidated.


ESTIMATE
AN ARCO Water Regulator on this Boiler will relieve you of all attention to the drafts.
By automatically opening and closing the dampers, it brings the water in the heating system up to any desired temperature and keeps it there. It prevents over-heating and therefore saves fuel.
We can equip this plant with an ARCO Water Regulator for $ extra.

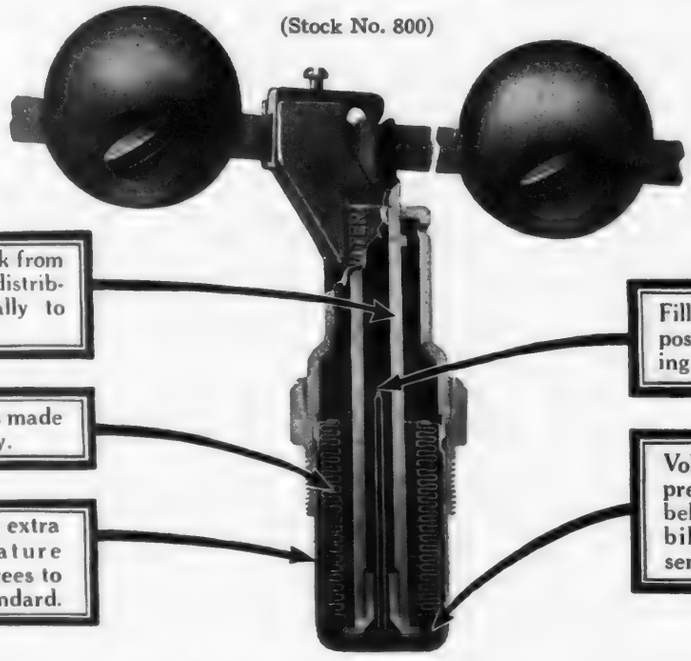
An easy recipe for *extra profits*

ALL YOU DO is moisten the gummed side of the sticker shown above, and paste the little paper on your estimate for any hot water job. The sticker does the rest. It works without pay—making more profits for you.

This is a courteous way of reminding your customer that he needs an ARCO Water Regulator. And it is the contractor's duty to let him know about this important piece of equipment.

You can have as many stickers as you need, by writing a postal to our nearest branch.

(Stock No. 800)



Stem transfers work from bottom of bellows distributing travel equally to each fold.

One piece bellows made in our own factory.

Design provides extra long temperature range—100 degrees to 220 degrees standard.

Filling tube provides positive method of sealing liquid chamber.

Volatile liquid develops pressure on outside of bellows. Gives durability, accuracy and sensitiveness.

You can get ARCO Water Regulator from your jobber or from our nearest branch

AMERICAN RADIATOR COMPANY

IDEAL Boilers and AMERICAN Radiators for every heating need

1807 Elmwood Avenue Dept. S Buffalo, N. Y.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

One-Column Steam, Enclosed, Full-Front Registers

STEAM AT 215°F.

1 COLUMN RADIATOR

REGISTER 60% OPEN

ENCLOSED RATING FULL FRONT REGISTER

SECTIONS	LENGTH IN INCHES	38"			32"			26"			23"			20"		
		Actual Surface	Equivalent Surface at 250 B.t.u. per sq. ft.		Actual Surface	Equivalent Surface at 250 B.t.u. per sq. ft.		Actual Surface	Equivalent Surface at 250 B.t.u. per sq. ft.		Actual Surface	Equivalent Surface at 250 B.t.u. per sq. ft.		Actual Surface	Equivalent Surface at 250 B.t.u. per sq. ft.	
			D=2½"	D=6"		D=2½"	D=6"		D=2½"	D=6"		D=2½"	D=6"		D=2½"	D=6"
2	5	6	6.3	7.1	5	5.4	6.1	4	4.5	5.0	3⅓	3.8	4.3	3	3.4	3.9
3	7½	9	8.6	9.7	7½	7.4	8.3	6	6.1	6.8	5	5.2	5.9	4½	4.7	5.3
4	10	12	10.8	11.8	10	9.3	10.4	8	7.7	8.6	6⅔	6.6	7.4	6	5.9	6.7
5	12½	15	13.0	14.7	12½	11.3	12.7	10	9.3	10.4	8⅓	7.9	8.9	7½	7.2	8.1
6	15	18	15.4	17.3	15	13.3	14.9	12	10.1	12.3	10	8.5	9.5	9	8.4	9.5
7	17½	21	17.6	19.8	17½	15.3	17.2	14	12.6	14.1	11⅔	10.6	11.1	10½	9.8	10.9
8	20	24	19.9	22.0	20	17.3	19.4	16	14.2	15.9	13⅓	12.1	13.1	12	10.1	12.3
9	22½	27	22.2	25.0	22½	19.3	21.7	18	15.8	17.8	15	13.5	15.2	13½	12.3	13.9
10	25	30	24.5	27.6	25	21.3	23.9	20	17.4	13.6.	16⅔	14.9	16.7	15	13.5	15.2
11	27½	33	26.8	30.2	27½	23.2	26.1	22	19.0	21.4	18⅓	16.2	18.3	16½	14.8	16.7
12	30	36	29.1	33.7	30	25.2	28.3	24	20.1	22.6	20	17.6	19.8	18	15.4	17.4
13	32½	39	31.4	35.4	32½	27.2	30.6	26	22.3	25.1	21⅔	19.0	21.4	19½	17.4	19.5
14	35	42	33.6	37.8	35	29.2	32.8	28	23.9	26.9	23⅓	20.4	22.1	21	18.6	20.9
15	37½	45	36.0	40.5	37½	31.4	35.1	30	25.6	28.8	25	21.8	24.6	22½	19.8	22.3
16	40	48	38.2	43.0	40	33.1	37.3	32	27.2	30.6	26⅔	23.2	26.1	24	21.1	23.8
17	42½	51	40.4	45.5	42½	35.1	39.5	34	28.8	32.4	28⅓	24.6	27.6	25½	22.6	25.5
18	45	54	42.6	47.1	45	36.1	41.6	36	30.5	34.3	30	25.9	29.2	27	23.6	26.5
19	47½	57	45.0	50.7	47½	39.0	43.9	38	32.2	36.2	31⅔	27.4	30.8	28½	25.2	28.3
20	50	60	47.2	53.0	50	40.1	46.1	40	33.8	37.1	33⅓	28.6	32.2	30	26.1	29.3
21	52½	63	49.4	55.0	52½	42.8	48.2	42	35.3	39.7	35	30.0	33.8	31½	27.4	31.8
22	55	66	51.7	58.1	55	44.9	50.5	44	37.3	41.9	36⅔	31.4	35.4	33	28.6	32.1
23	57½	69	53.8	61.6	57½	46.7	52.6	46	38.6	43.4	38⅓	32.7	36.8	34½	29.8	33.6
24	60	72	56.0	63.0	60	48.7	54.8	48	40.6	45.6	40	34.2	38.4	36	31.0	34.9
25	62½	75	58.3	65.6	62½	50.6	56.9	50	41.8	46.1	41⅔	35.4	39.9	37½	32.4	36.5
26	65	78	60.6	68.2	65	52.6	59.1	52	43.4	48.8	43⅓	36.6	41.1	39	33.7	37.9
27	67½	81	62.1	70.8	67½	54.6	61.5	54	45.0	50.7	45	38.2	43.0	40½	34.8	39.2
28	70	84	65.0	73.2	70	56.4	63.5	56	46.1	52.8	46⅔	39.5	44.5	42	36.1	40.6
29	72½	87	67.0	75.4	72½	58.2	65.5	58	48.0	54.0	48⅓	40.8	45.9	43½	37.3	41.9
30	75	90	69.4	78.0	75	60.2	67.8	60	49.6	55.8	50	42.2	47.5	45	38.4	43.2
31	77½	93	71.4	80.3	77½	62.0	69.8	62	51.1	57.5	51⅔	43.4	48.9	46½	39.5	44.5
32	80	96	73.7	82.9	80	64.1	72.1	64	52.8	59.4	53⅓	44.9	50.5	48	40.8	45.9
33	82½	99	73.7	85.1	82½	65.6	73.8	66	54.2	61.0	55	46.1	51.8	49½	42.0	47.3
34	85	102	78.0	87.8	85	67.7	76.1	68	55.9	62.9	56⅔	47.4	53.4	51	43.2	48.6
35	87½	105	79.9	89.9	87½	69.4	78.1	70	57.3	64.4	58⅓	48.7	54.8	52½	44.0	49.5
36	90	108	82.2	92.5	90	71.4	80.3	72	58.1	66.3	60	50.1	56.3	54	45.6	51.3
37	92½	111	84.2	94.7	92½	73.1	82.3	74	60.0	67.9	61⅔	51.3	57.7	55½	46.9	52.7
38	95	114	86.4	97.2	95	75.0	84.4	76	62.0	69.8	63⅓	52.6	59.2	57	47.9	53.9
39	97½	117	88.4	99.5	97½	76.8	86.4	78	63.4	71.3	65	53.8	60.6	58½	49.7	55.4
40	100	120	90.6	101.9	100	78.7	88.6	80	64.1	73.1	66⅔	55.2	62.1	60	50.5	56.8

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RADIATOR RATINGS—1-COL. STEAM, ENCLOSED, FULL-FRONT REGISTERS — No. 14-H

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Two-Column Steam, Enclosed, Full-Front Registers

STEAM AT 215°F

2 COLUMN RADIATOR

ENCLOSED RATING
FULL FRONT REGISTER

SECTIONS	LENGTH IN INCHES	45" Actual Surface	45" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	45" D=6"	38" Actual Surface	38" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	38" D=6"	32" Actual Surface	32" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	32" D=6"	26" Actual Surface	26" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	26" D=6"	23" Actual Surface	23" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	23" D=6"	20" Actual Surface	20" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	20" D=6"
2	5	10	9.5	10.7	8	7.9	8.9	6⅔	6.4	7.2	5⅓	5.4	6.1	4⅔	4.1	5.6	4	4.2	4.8
3	7½	15	13.0	14.7	12	9.7	12.1	10	9.2	10.4	8	7.4	8.3	7	6.7	7.6	6	5.9	6.7
4	10	20	16.4	18.5	16	13.4	15.1	13⅓	11.6	12.1	10⅔	9.7	10.9	9⅓	8.5	9.5	8	7.4	8.4
5	12½	25	19.7	22.1	20	16.2	18.2	16⅔	15.1	15.8	13⅓	11.6	13.1	11⅔	11.1	12.5	10	8.9	10.1
6	15	30	23.6	24.8	24	19.2	21.6	20	16.5	18.5	16	12.8	15.5	14	12.2	13.7	12	10.6	11.9
7	17½	35	26.9	30.2	28	22.2	24.9	23⅓	18.0	22.3	18⅔	15.8	17.8	16⅓	13.9	15.7	14	12.2	13.7
8	20	40	30.4	34.2	32	24.1	28.1	26⅔	21.5	24.2	21⅓	17.8	19.1	18⅔	15.8	17.7	16	13.8	15.5
9	22½	45	33.9	38.2	36	27.8	31.2	30	24.0	27.0	24	19.7	22.1	21	17.6	19.8	18	15.4	17.3
10	25	50	37.4	42.1	40	30.7	34.6	33⅓	26.4	29.7	26⅔	21.8	24.6	23⅓	19.4	21.8	20	16.1	19.1
11	27½	55	40.9	45.1	44	33.5	37.7	36⅔	28.9	32.5	29⅓	23.7	26.6	25⅔	21.2	23.9	22	18.5	20.8
12	30	60	44.3	49.9	48	36.5	40.9	40	31.2	35.1	32	25.7	28.9	28	22.1	25.8	24	20.2	22.7
13	32½	65	47.9	53.9	52	39.3	44.2	43⅓	33.7	37.9	34⅔	27.6	31.1	30⅓	24.6	27.7	26	21.6	24.3
14	35	70	51.4	57.8	56	42.1	47.3	46⅔	36.2	40.7	37⅓	29.6	33.3	32⅔	26.5	29.8	28	23.2	26.1
15	37½	75	54.7	61.6	60	44.1	50.6	50	38.6	43.3	40	31.6	35.6	35	28.2	31.8	30	24.8	27.9
16	40	80	58.2	65.4	64	47.7	53.6	53⅓	40.1	46.1	42⅔	33.6	37.8	37⅓	30.0	33.8	32	26.4	29.3
17	42½	85	61.6	69.3	68	50.5	56.8	56⅔	43.4	48.8	45⅓	35.5	39.1	39⅔	31.8	35.7	34	27.8	31.3
18	45	90	65.0	73.2	72	53.4	60.2	60	45.9	51.7	48	37.6	42.4	42	33.6	37.8	36	29.4	33.1
19	47½	95	68.5	76.9	76	56.3	63.4	63⅓	48.2	54.3	50⅔	39.4	44.4	44⅓	35.3	39.7	38	31.0	34.9
20	50	100	71.7	80.6	80	58.8	66.2	66⅔	50.6	56.9	53⅓	41.5	46.7	46⅔	37.1	41.8	40	32.5	36.5
21	52½	105	75.3	84.7	84	61.8	69.5	70	53.1	59.8	56	43.4	48.9	49	38.9	43.7	42	34.2	38.4
22	55	110	78.6	88.4	88	64.5	72.5	73⅓	55.4	62.3	58⅔	45.5	51.2	51⅓	40.7	45.8	44	35.6	40.1
23	57½	115	82.2	92.5	92	67.4	75.8	76⅔	58.0	65.3	61⅓	47.5	52.5	53⅔	42.4	47.7	46	37.2	41.9
24	60	120	85.4	96.0	96	70.0	78.8	80	60.2	67.8	64	49.4	55.6	56	44.1	49.6	48	38.7	43.6
25	62½	125	88.8	99.9	100	73.0	82.2	83⅓	62.6	70.5	66⅔	51.4	57.8	58⅓	45.8	51.6	50	40.3	45.4
26	65	130	92.0	103.5	104	75.6	85.1	86⅔	64.8	72.9	69⅓	53.6	60.3	60⅔	48.2	54.2	52	41.9	47.2
27	67½	135	95.7	107.1	108	78.4	88.2	90	67.4	75.9	72	55.2	62.1	63	49.5	55.7	54	43.4	48.8
28	70	140	98.5	110.8	112	80.9	90.1	93⅓	69.5	78.2	74⅔	57.4	64.6	65⅓	51.1	57.5	56	44.1	50.6
29	72½	145	102.1	114.8	116	83.1	94.4	96⅔	72.2	81.3	77⅓	59.2	66.6	67⅔	52.8	59.4	58	46.4	52.2
30	75	150	105.3	118.4	120	86.4	97.2	100	74.2	83.5	80	61.0	68.6	70	54.5	61.3	60	47.9	53.9
31	77½	155	108.5	122.0	124	88.9	99.1	103⅓	76.7	86.3	82⅔	62.6	70.4	72⅓	56.0	63.0	62	49.1	55.3
32	80	160	111.2	125.1	128	91.8	103.4	106⅔	78.8	88.7	85⅓	64.8	72.9	74⅔	57.8	64.1	64	50.6	56.1
33	82½	165	114.6	128.9	132	94.2	106.0	110	80.9	90.1	88	66.5	74.8	77	59.4	66.8	66	52.2	58.7
34	85	170	118.0	132.8	136	96.1	109.1	113⅓	83.4	93.9	90⅔	68.2	76.8	79⅓	61.1	68.8	68	53.8	60.5
35	87½	175	120.1	136.1	140	99.4	111.8	116⅔	85.6	96.3	93⅓	70.2	79.1	81⅔	62.6	70.5	70	55.1	62.0
36	90	180	124.6	139.1	144	102.3	115.1	120	88.0	99.0	96	72.1	81.2	84	64.5	72.5	72	56.6	63.7
37	92½	185	127.9	143.9	148	104.1	118.1	123⅓	90.4	101.7	98⅔	74.2	83.5	86⅓	66.3	74.6	74	58.2	65.5
38	95	190	130.6	146.1	152	107.4	120.8	126⅔	92.4	103.1	101⅓	76.2	85.7	88⅔	67.9	76.4	76	59.7	67.1
39	97½	195	134.2	151.0	156	110.4	124.2	130	94.9	106.1	104	77.9	87.7	91	69.6	78.3	78	61.1	68.8
40	100	200	137.6	154.8	160	113.3	127.4	133⅓	97.3	109.4	106⅔	80.0	90.0	93⅓	71.4	80.3	80	62.6	70.4

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RADIATOR RATINGS—2-COL. STEAM, ENCLOSED, FULL-FRONT REGISTERS — No. 14-I

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Three-Column Steam, Enclosed, Full-Front Registers

STEAM AT 215° F.

3 COLUMN RADIATOR

ENCLOSED RATING FULL FRONT REGISTER

SECTIONS	LENGTH IN INCHES	45" Actual Surface	45" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	45" D=6"	38" Actual Surface	38" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	38" D=6"	32" Actual Surface	32" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	32" D=6"	26" Actual Surface	26" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	26" D=6"	22" Actual Surface	22" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	22" D=6"	18" Actual Surface	18" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	18" D=6"
2	5	12	10.6	11.1	10	9.1	10.3	9	8.6	9.6	7½	7.4	8.3	6	6.1	6.8	4½	4.6	5.1
3	7½	18	14.5	16.3	15	12.9	13.9	13½	11.7	13.1	11¼	10.0	11.3	9	8.2	9.3	6¾	6.2	6.9
4	10	24	18.2	20.5	20	15.7	17.6	18	14.4	16.2	15	12.6	14.2	12	10.4	11.7	9	8.1	9.1
5	12½	30	22.1	24.8	25	18.9	21.3	22½	17.7	19.9	18¾	15.3	17.2	15	12.6	14.2	11¼	9.8	10.1
6	15	36	25.9	29.2	30	22.5	25.4	27	20.7	23.3	22½	18.0	19.3	18	14.8	16.7	13½	11.6	13.1
7	17½	42	29.8	33.6	35	25.7	28.1	31½	23.9	26.9	26¼	20.6	23.1	21	17.1	19.3	15¾	13.2	14.9
8	20	48	33.8	37.1	40	29.4	33.1	36	27.0	31.4	30	23.5	26.5	24	19.2	21.6	18	14.1	16.8
9	22½	54	38.0	42.8	45	32.7	36.8	40½	30.5	34.3	33¾	25.9	29.2	27	21.6	24.3	20¼	16.6	18.6
10	25	60	41.8	46.1	50	36.0	40.5	45	33.4	37.6	37½	28.8	32.4	30	23.8	26.7	22½	18.3	20.6
11	27½	66	45.4	51.0	55	39.6	44.6	49½	36.4	40.1	41¼	31.4	35.3	33	25.8	29.1	24¾	19.9	22.4
12	30	72	49.5	55.7	60	42.9	48.2	54	39.7	44.6	45	34.2	38.4	36	28.2	31.8	27	21.7	24.4
13	32½	78	53.7	60.4	65	46.2	51.0	58½	42.9	48.3	48¾	36.6	41.2	39	29.9	33.7	29¼	23.4	26.4
14	35	84	57.8	64.1	70	49.8	56.1	63	45.8	51.6	52½	39.5	44.5	42	32.6	36.6	31½	25.2	28.4
15	37½	90	61.2	68.9	75	52.8	59.4	67½	49.1	55.3	56¼	42.3	47.6	45	34.1	38.3	33¾	26.8	30.2
16	40	96	65.3	73.4	80	56.3	63.4	72	52.4	58.1	60	45.1	50.8	48	36.9	41.5	36	28.6	32.1
17	42½	102	69.4	78.0	85	59.9	67.4	76½	55.7	61.6	63¾	47.9	53.9	51	39.2	44.1	38¼	30.3	34.1
18	45	108	72.6	81.6	90	63.3	71.3	81	58.1	65.4	67½	50.2	56.5	54	41.4	46.6	40½	32.0	36.0
19	47½	114	76.6	86.2	95	66.1	74.3	85½	61.6	69.3	71¼	53.0	59.7	57	43.8	49.2	42¾	33.6	37.8
20	50	120	80.1	90.1	100	69.6	78.3	90	64.8	72.9	75	55.8	62.8	60	46.1	51.8	45	35.5	39.1
21	52½	126	84.6	95.2	105	73.0	82.2	94½	67.3	75.7	78¾	58.0	65.3	63	47.9	53.9	47¼	37.1	41.8
22	55	132	88.6	99.7	110	76.5	86.1	99	70.5	79.3	82½	60.7	68.3	66	50.5	56.8	49½	38.8	43.7
23	57½	138	92.7	104.3	115	80.1	90.1	103½	73.7	82.9	86¼	63.5	71.5	69	52.9	59.5	51¾	40.6	45.6
24	60	144	95.7	107.6	120	82.5	92.9	108	76.9	86.5	90	66.2	74.5	72	54.7	61.6	54	42.2	47.5
25	62½	150	99.6	112.1	125	86.0	96.8	112½	80.1	90.1	93¾	69.0	77.7	75	57.0	64.2	56¼	43.3	48.7
26	65	156	103.5	116.5	130	89.4	100.6	117	83.3	93.7	97½	71.4	80.4	78	59.3	66.7	58½	45.8	51.6
27	67½	162	107.5	121.0	135	92.9	104.5	121½	86.5	96.2	101¼	73.7	82.1	81	60.9	68.5	60¾	47.2	53.1
28	70	168	110.2	123.9	140	96.3	108.4	126	88.2	99.3	105	76.4	85.1	84	63.2	71.1	63	48.8	54.9
29	72½	174	114.1	128.3	145	99.7	112.2	130½	91.9	103.4	108¾	79.2	89.1	87	65.4	73.6	65¼	50.6	56.9
30	75	180	118.1	132.8	150	102.0	114.8	135	95.0	106.9	112½	81.8	92.1	90	67.2	76.1	67½	52.1	58.6
31	77½	186	121.2	136.4	155	105.2	118.5	139½	98.2	110.5	116¼	84.6	95.2	93	69.9	78.7	69¾	53.6	60.3
32	80	192	125.9	141.9	160	108.8	122.4	144	101.3	114.0	120	87.4	98.3	96	72.2	81.2	72	55.2	62.1
33	82½	198	129.8	146.1	165	112.2	126.2	148½	103.3	116.3	123¾	90.0	101.3	99	73.7	82.9	74¼	57.0	64.2
34	85	204	133.8	150.5	170	115.6	130.1	153	106.5	119.8	127½	92.8	104.4	102	75.9	85.4	76½	58.6	65.1
35	87½	210	136.1	153.1	175	117.6	132.3	157½	108.7	123.5	131¼	95.1	107.0	105	78.2	87.9	78¾	60.1	67.6
36	90	216	139.9	157.4	180	120.9	136.1	162	112.8	126.9	135	98.4	110.7	108	80.3	90.4	81	62.2	69.9
37	92½	222	143.8	161.8	185	124.3	139.9	166½	115.6	130.1	138¾	100.1	112.6	111	82.6	92.9	83¼	63.9	71.9
38	95	228	147.7	166.1	190	127.7	143.6	171	118.6	133.5	142½	102.4	115.2	114	84.6	95.2	85½	65.2	73.4
39	97½	234	151.6	170.6	195	131.0	147.2	175½	123.1	138.5	146¼	104.9	117.1	117	86.2	97.0	87¾	66.6	74.1
40	100	240	156.0	175.5	200	134.4	151.2	180	124.5	140.0	150	107.2	120.6	120	88.3	99.4	90	68.6	77.2

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RADIATOR RATINGS—3-COL. STEAM, ENCLOSED, FULL-FRONT REGISTERS | No. 14-J

Copies of this Data Sheet, printed separately, 5 cents each.

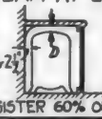
THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Four-Column Steam, Enclosed, Full-Front Registers

STEAM AT 215°F

4 COLUMN RADIATOR



REGISTER 60% OPEN

ENCLOSED RATING FULL FRONT REGISTER

SECTIONS	LENGTH IN INCHES	45" Actual Surface	45" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	45" D=6"	38" Actual Surface	38" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	38" D=6"	32" Actual Surface	32" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	32" D=6"	26" Actual Surface	26" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	26" D=6"	22" Actual Surface	22" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	22" D=6"	18" Actual Surface	18" Equivalent Surface at 250 B.t.u. per sq. ft. D=2½"	18" D=6"
2	6	20	16.8	18.9	16	13.8	15.5	13	11.6	13.1	10	9.1	10.3	8	7.6	8.6	6	5.8	6.6
3	9	30	22.9	25.7	24	18.6	20.1	19½	15.7	17.6	15	12.5	14.0	12	10.3	11.6	9	7.9	8.9
4	12	40	28.8	32.4	32	23.5	26.5	26	19.8	22.3	20	15.8	17.7	16	13.0	14.7	12	10.0	11.3
5	15	50	34.8	39.2	40	28.4	31.1	32½	23.9	26.9	25	19.0	21.4	20	15.8	17.7	15	12.1	13.6
6	18	60	40.1	46.1	48	33.8	37.1	39	28.2	31.7	30	22.5	25.3	24	18.5	20.8	18	14.2	16.0
7	21	70	47.3	53.2	56	38.6	41.9	45½	32.5	36.5	35	25.8	29.1	28	21.4	24.1	21	16.4	18.5
8	24	80	53.5	60.2	64	43.8	49.3	52	36.7	40.3	40	29.4	33.0	32	24.2	27.2	24	18.6	20.9
9	27	90	59.7	67.1	72	48.8	54.9	58½	41.0	46.7	45	32.6	36.7	36	26.1	30.3	27	20.7	23.3
10	30	100	65.6	73.8	80	53.8	60.6	65	45.0	50.7	50	35.9	40.4	40	29.6	33.3	30	22.9	25.7
11	33	110	71.9	80.9	88	58.0	66.4	71½	49.4	55.5	55	39.5	41.5	44	32.4	36.5	33	25.8	28.2
12	36	120	77.9	87.7	96	64.2	72.2	78	53.6	60.3	60	42.9	48.2	48	36.2	39.6	36	27.2	30.6
13	39	130	83.9	94.4	104	68.7	77.3	84½	57.8	65.1	65	46.1	51.8	52	38.0	42.8	39	29.4	33.0
14	42	140	90.6	101.9	110	74.1	83.3	91	62.4	70.2	70	49.6	55.8	56	40.8	45.9	42	31.6	35.6
15	45	150	96.4	108.5	120	78.1	88.8	97½	66.4	74.7	75	52.1	59.6	60	43.5	48.1	45	33.8	37.1
16	48	160	102.4	115.2	128	84.0	94.5	104	70.6	79.4	80	56.4	63.5	64	46.2	51.9	48	35.8	40.2
17	51	170	108.8	122.4	136	89.0	100.2	110½	74.1	84.3	85	59.8	67.2	68	49.0	55.2	51	38.1	42.8
18	54	180	114.6	128.9	144	94.0	105.8	117	78.9	88.7	90	63.2	71.1	72	51.8	58.3	54	40.0	45.0
19	57	190	120.5	135.5	152	98.6	110.1	123½	82.8	93.2	95	66.4	74.7	76	54.6	61.4	57	42.0	47.3
20	60	200	126.8	142.7	160	104.2	117.3	130	87.4	98.3	100	69.8	78.5	80	57.4	64.5	60	44.2	49.7
21	63	210	132.2	148.7	168	108.3	121.9	136½	91.4	102.9	105	72.8	81.9	84	60.2	67.7	63	46.4	52.2
22	66	220	138.7	156.1	176	113.7	127.9	143	95.8	107.8	110	76.2	85.7	88	62.1	70.8	66	48.6	54.6
23	69	230	144.9	162.1	184	118.1	133.8	149½	100.2	112.7	115	79.8	90.8	92	65.8	73.1	69	50.7	57.1
24	72	240	150.5	169.3	192	123.4	138.8	156	104.0	117.0	120	82.8	93.2	96	67.9	76.4	72	52.9	59.5
25	75	250	157.0	176.6	200	128.6	144.6	162½	108.2	121.7	125	86.1	96.8	100	70.1	79.8	75	55.1	62.0
26	78	260	162.4	182.7	208	133.8	150.6	169	112.8	126.9	130	89.6	100.8	104	73.8	83.1	78	57.2	64.0
27	81	270	168.4	189.5	216	137.9	155.2	175½	116.2	130.8	135	92.1	104.6	108	76.1	85.6	81	59.2	66.6
28	84	280	173.8	195.6	224	143.2	161.1	182	120.0	135.0	140	96.0	108.0	112	78.8	88.7	84	60.9	68.5
29	87	290	180.0	202.9	232	147.4	165.9	188½	123.8	139.3	145	99.4	111.8	116	81.6	91.8	87	63.1	71.0
30	90	300	185.4	208.6	240	152.0	171.0	195	127.9	143.9	150	102.4	115.2	120	84.2	94.8	90	64.1	73.1
31	93	310	191.4	215.4	248	157.4	177.0	201½	131.8	148.2	155	105.6	118.8	124	86.9	97.7	93	67.1	75.5
32	96	320	197.6	222.3	256	162.2	182.5	208	136.8	153.9	160	109.2	122.9	128	90.0	101.3	96	69.2	77.9
33	99	330	202.6	227.1	264	166.4	187.2	214½	140.4	157.1	165	112.0	126.0	132	92.1	103.6	99	71.2	80.1
34	102	340	208.0	234.0	272	171.6	193.1	221	144.0	162.0	170	115.2	129.6	136	94.9	106.7	102	73.4	82.5
35	105	350	213.6	240.3	280	175.6	197.5	227½	148.0	166.5	175	117.8	132.5	140	96.1	108.1	105	75.4	84.8
36	108	360	220.0	247.5	288	180.7	203.3	234	152.8	171.9	180	120.1	136.1	144	99.8	112.2	108	77.6	87.3
37	111	370	226.4	254.7	296	185.6	208.8	240½	156.4	175.1	185	124.8	140.4	148	102.0	114.8	111	79.4	89.4
38	114	380	231.2	260.1	304	189.6	213.3	247	159.2	179.1	190	127.4	143.3	152	104.6	117.6	114	80.9	90.1
39	117	390	236.8	266.4	312	195.0	219.4	253½	163.8	184.3	195	130.8	147.2	156	107.2	120.6	117	83.2	93.6
40	120	400	242.0	272.2	320	198.6	223.4	260	167.4	188.3	200	134.4	151.2	160	110.0	123.8	120	85.2	95.9

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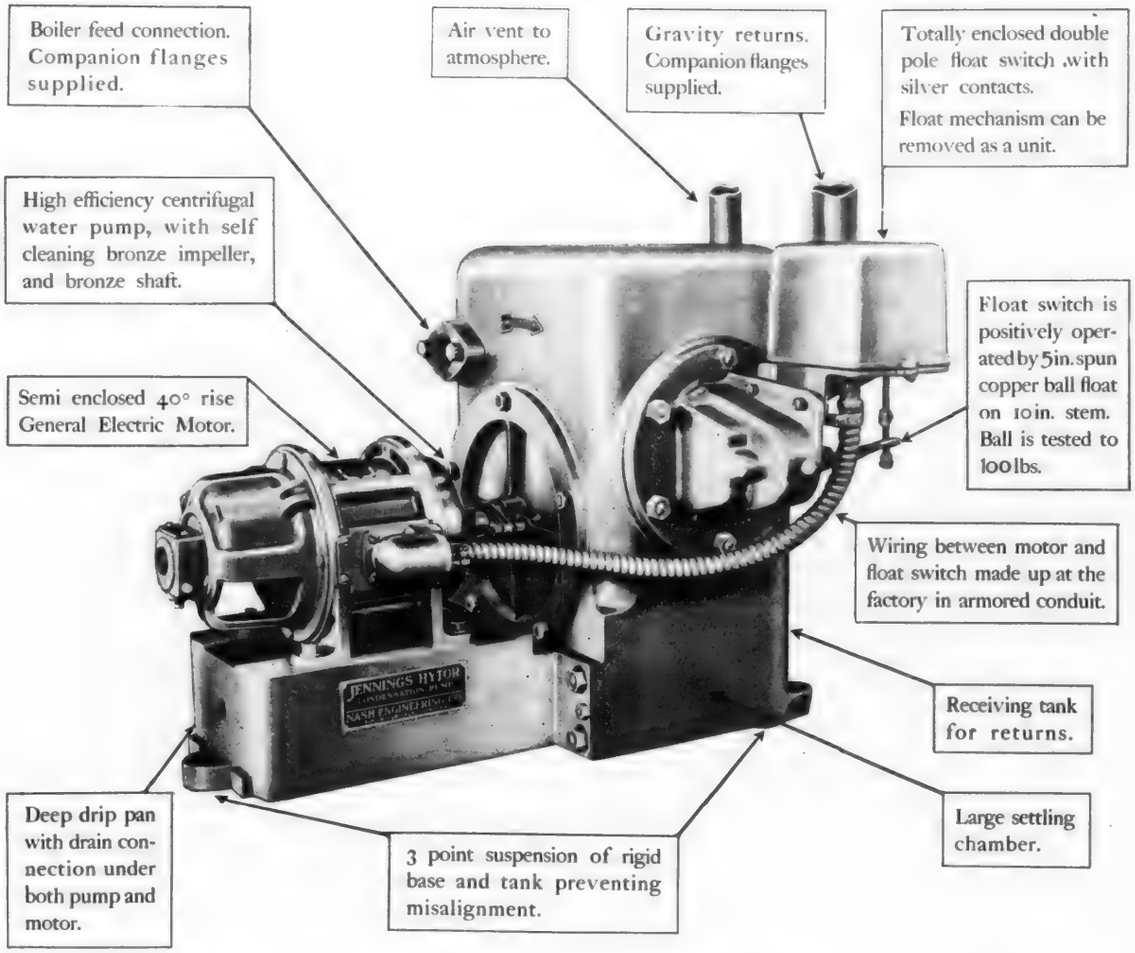
RADIATOR RATINGS—4-COL. STEAM, ENCLOSED, FULL-FRONT REGISTERS — No. 14-K

Copies of this Data Sheet, printed separately, 5 cents each.

THE NEW UNIT TYPE JENNINGS HYTOR CONDENSATION PUMPS


Boiler feed connection. Companion flanges supplied.
Air vent to atmosphere.
Gravity returns. Companion flanges supplied.
Totally enclosed double pole float switch with silver contacts.
Float mechanism can be removed as a unit.
High efficiency centrifugal water pump, with self cleaning bronze impeller, and bronze shaft.
Float switch is positively operated by 5in. spun copper ball float on 10in. stem. Ball is tested to 100lbs.
Semi enclosed 40° rise General Electric Motor.
Wiring between motor and float switch made up at the factory in armored conduit.
Receiving tank for returns.
Large settling chamber.
Deep drip pan with drain connection under both pump and motor.
3 point suspension of rigid base and tank preventing misalignment.
JENNINGS HYTOR
NASH ENGINEERING CO.

The illustration shows construction of the Jennings Condensation Pump Unit. By making the pump casing a part of the receiving tank and bolting to the tank the base supporting the motor, allowing the motor bearings to support the bronze impeller, great structural strength is secured. The three point support prevents the pump from being sprung ont of line.

Large motor bearings supplied with ample oil wells support the pump impeller and keep it in alignment. Only occasional lubrication is necessary. The impeller is open type, self-cleaning, and very efficient.

The float switch mechanism is liberally proportioned, equipped with bronze shaft supported by two bearings.

The special G. E. double-pole float switch is totally enclosed and provided with silver contacts for long life. Switch mechanism can be removed as a unit.

The finest materials and best workmanship used in construction throughout, and all parts are machined to such close limits that absolute interchangeability is secured.

For Detailed Description Ask for Bulletin No. 29

NASH ENGINEERING CO.

SO. NORWALK CONN., U. S. .A

NASH ENGINEERING CO., South Norwalk, Conn., U. S. A.
Please send graphic device also bulletins covering
[ ] Hytor Air Compressors
[ ] Hytor Vacuum Pumps
[ ] Return Line Heating Pumps
[ ] Condensation Pumps
Name.....
Company.....
Position.....
Jan.

Trade and Miscellaneous Notes

Coming Events

May 21-23.—Fifteenth annual convention of the National Pipe and Supplies Association, in Cleveland, O. Headquarters will be at the Hotel Cleveland.

May 26-29, 1924.—Annual convention of the Heating and Piping Contractor's National Association, in Atlantic City, N. J. Headquarters will be at the Chalfonte-Haddon Hall.

June 10-12, 1924.—Mid-summer meetting of the American Society of Heating and Ventilating Engineers, in Kansas City, Mo.

June 10-12, 1924.—Annual convention of the National District Heating Association, in New York City. Headquarters at the Hotel Commodore.

June 24-26, 1924.—Forty-second annual convention of the National Association of Master Plumbers, in West Baden, Ind. Headquarters at the West Baden Springs Hotel.

Miscellaneous Notes

National Association of Public School Business Officials announces that its anual meeting will be held at the Claypool Hotel, Indianapolis, Ind., May 12 to 16, 1924. John S. Mount, Trenton, N. J., is secretary of the association.

Building Construction in February showed a slight decrease both over the previous month and the same month a year ago, the total this year being $299,929,100 according to reports received by the F. W. Dodge Corporation from 36 States, comprising about seven-eights of the total construction volume of the country. On the other hand the *American Contractor* reported that building permits for February showed an increase over January. This latter would indicate that plans for new construction continue in large volume.

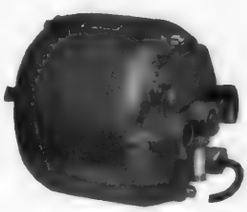
Central Supply Association held its 92nd regular meeting at the Drake Hotel in Chicago, February 20 and 21, 1924. Among the papers read were "Future Delivery Orders" by Charles K. Foster, vice-president of the American Radiator Co.; "Range Boilers—Standardization" by Frank Sutcliffe, president of the Wolff Range Boiler Mfg. Co.; and "Soil Pipe and Fittings" by Wm. M. Byrd, Jr., vice-president of the Hammond Byrd Iron Co. J. R. Steneck, sales manager of the Illinois Malleable Iron Co., rendered an interesting report of the work of the Code of Ethics Committee.

Standardized Catalogs for salesmen have been adopted by 232 firms and 88 other firms already have the standardized binder in actual use, announces the National Trade Extension Bureau. A total of 1313 T. E. B. binders, the type adopted, has been forwarded to firms, it is stated. The project to standardize salesmen's catalogs was first placed before the Eastern and Central Supply associations, both organizations adopting the report.

National Metal Trades Association, Chicago Branch, selected new officers as follows at its recent meeting at the Mid-Day Club in Chicago: President, Charles H. Strawbridge, Goodman Manufacturing Co.; vice president, Henry Beneke, Beneke & Kropf Manufacturing Co.; treasurer, Charles E. Finkl, A. Finkl & Sons Co.; and secretary, Paul Blatchford, 139 North Clark St. A feature of the meeting was an address by George A. Ranney, vice-president and treasurer of the International Harvester Co., on "Agriculture and Industry."

Heating Contractors Association, of Brooklyn, N. Y. featured the practice of "certified heating" at their booth at the second annual "Buy your own Home" show, held at the Brooklyn Ice Palace, March 29 to April 5, 1924. In addition to the booth, where home owners were shown how heating plants are installed,

AUTOVENT ACID-MOISTURE PROOF FANS



Here is a fan that can be relied upon to operate efficiently under air conditions that prohibit the use of standard types of fans.

Autovent Acid-Moisture Proof Fans are especially designed for installations where extraordinarily unfavorable conditions prevail and are equipped with fully enclosed motors. The inspection covers are provided with gaskets and tight fitting joints, with motor leads projecting through frame of motor by means of threaded tapered bushings with gaskets.

Complete specifications are given in our 9th edition catalog—yours for the asking.

AUTOVENT FAN & BLOWER CO.

DEPT. "H"

730-738 W. Monroe St. - - - CHICAGO

OFFICES IN PRINCIPAL CITIES

the association distributed an attractive pamphlet entitled "The Heating Service Booklet." The organization also is advertising the "certified heating" idea in Brooklyn, in a magazine published by the Brooklyn Chamber of Commerce.

French Motor Car Manufacturers, in America for a trip of inspection, have turned their attention also to the subject of ventilation. A mission of sixteen men spent several days recently studying ventilation at the plant of the Carrier Engineering Corporation in Newark, N. J.

Heating and Piping Contractors Cleveland (Ohio) Association has appointed a special committee to investigate the field of oil burners, relative to application to the local heating field. Edward Maurer is chairman and W. B. Van Sickle and Charles Sobotta, members of this committee. Plans for a class in pipe welding at the Y. M. C. A. are also under consideration by the association.

Heating and Ventilation had a prominent place in the exhibits at the fourth annual "Own your Home" exposition at the Coliseum in Chicago March 22 to 29, 1924. Importance of a personal knowledge of such equipment was stressed by a special committee representing the heating and ventilating trade.

Manufacturers Notes

United States Radiator Corporation, Detroit, Mich., has opened a branch at 2439 Blake St., Denver, Colo., in charge of P. V. Rozier, who also is manager of the Omaha, Neb., branch.

Grinnell Co., of the Pacific, Los Angeles, Calif., has removed to 520 Mateo Street to obtain larger quarters. The company also has opened a new warehouse at Torrance, Calif.

Graver Corporation, East Chicago, Ind., has moved its New York office to Room 5045, Grand Central Terminal Building.

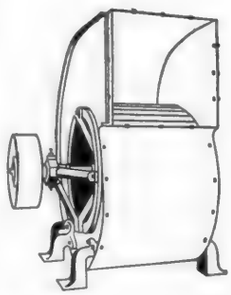
Automatic Gas Steam Radiator Co., Pittsburgh, Pa., has obtained larger quarters on the thirteenth floor of the Fulton Building, Pittsburgh.

Continental Heater Corporation, Dunkirk, N. Y., is building a brick and steel foundry 150x400 ft., to be used exclusively for the manufacture of boilers.

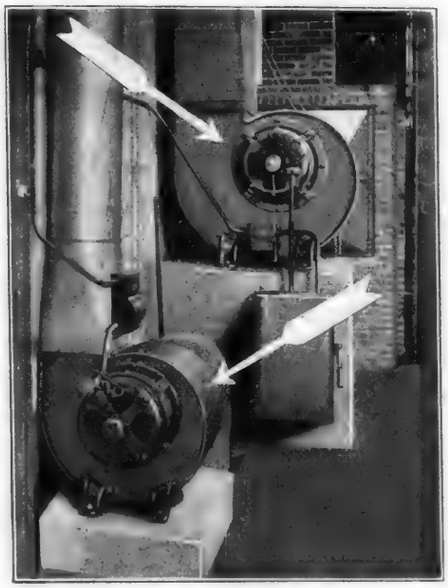
Sterling Engineering Co., has appointed new representatives as follows: A. H. Potbury, 216 Pare St., San Francisco, Calif.; J. H. Sutthoff, 1605 L. C. Smith

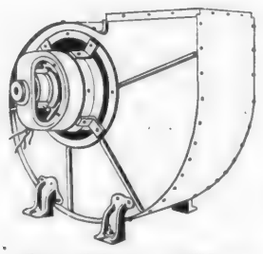
ILG

Universal Blowers are compact and interchangeable. They require no special pedestal for motor. There are no bearings in the suction inlet. All oiling is done on the motor or pulley side. These and other exclusive features are shown in a complete catalog. Send for it.



Belt Driven Type. Note Absence of Pedestal for Pulley.





Direct Connected Blower. Note Compactness.

There are a surprising number of ILG Universal Blowers in use in every part of the country. They are being specified by leading Architects and Engineers.

HIGH EFFICIENCY ILG VENTILATING MACHINERY

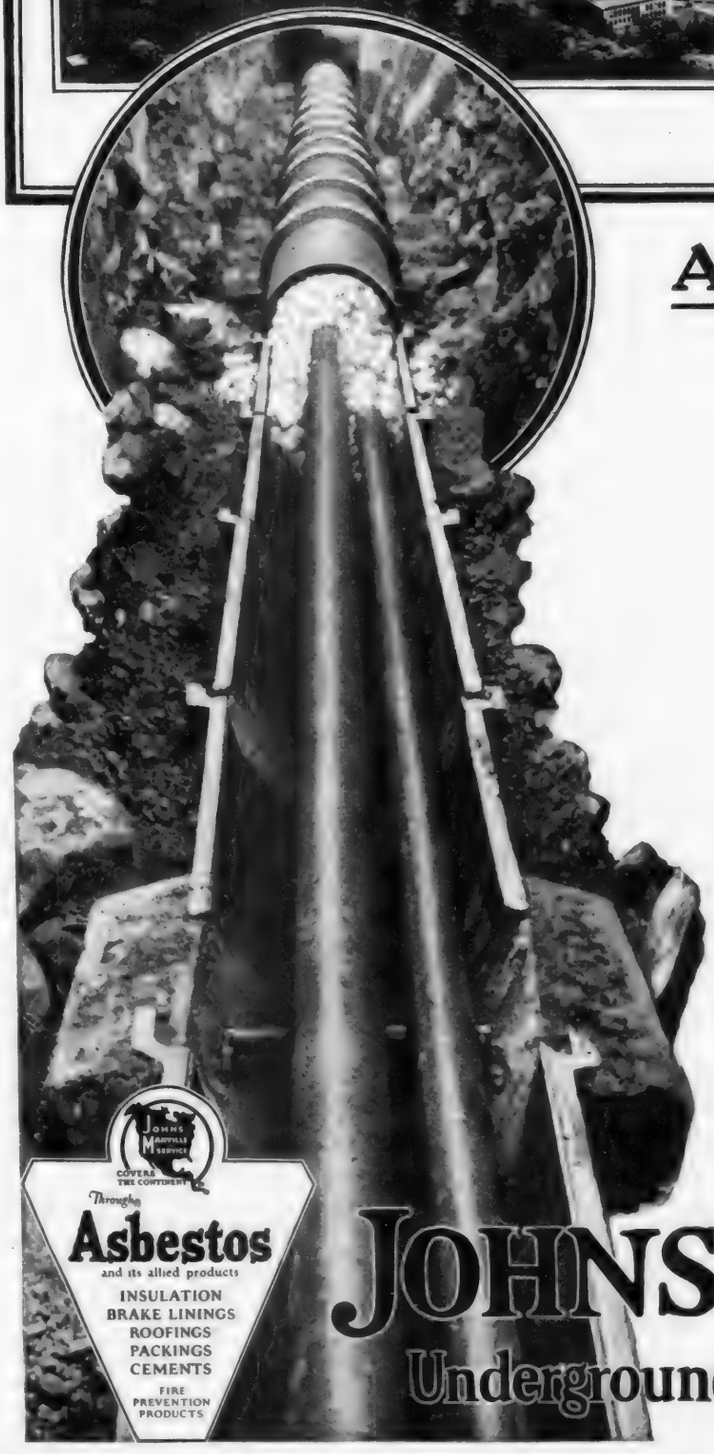
Ventilation

FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS · RESTAURANTS · THEATRES · HOUSES · ETC ·

ILG ELECTRIC VENTILATING CO. 2858 NORTH CRAWFORD AVE. CHICAGO

BRANCHES IN ALL PRINCIPAL CITIES

Airplane view by The Fairchild Aerial Camera Corp. Cornell University, Ithaca, N. Y. Buildings connected by Johns-Manville underground system of insulation. Note Power house shown at upper center.



At Cornell

—a two mile installation of the Johns-Manville system

Over two miles of the Johns-Manville Underground System of Insulation play an important part in the new 4500 H. P. central heating plant system at Cornell University.

Steam is transmitted underground at 200 lbs. boiler pressure to reducing valves at the buildings. This permits small mains to be used, which are insulated by the Johns-Manville System with minimum first cost, especially as compared with the far greater cost of walking tunnels. This method is not only less expensive, but more efficient which reduces operating losses to the absolute minimum—a double economy.

The Johns-Manville System combines an efficient method of insulating pipe lines underground with an engineering service that has been highly successful in adapting this method to specific problems Hundreds of successful installations bear witness to the exceptional economy of this system.

JOHNS-MANVILLE Inc.
294 Madison Avenue at 41st Street,
New York City
Branches in 62 Large Cities
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Johns-Manville Service
Covers the Continent

Through
Asbestos
and its allied products

INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE

Underground System of Insulation

building, Seattle, Wash., and George S Thompson, 1617 Bassett Ave., El Paso, Tex. The selections were made by Mr. C. J. Rice, president, who recently returned to the company's headquarters, Milwaukee, Wis., after an extensive tour of the Pacific coast and southern States.

Toledo Pipe Threading Machine Co., Toledo, O., is erecting an addition to its plant in Toledo.

Fox Furnace Co., Elyria, O., subsidiary of the American Radiator Co., has leased 7,534 sq. ft. in the warehouse building at Pershing Road and Ashland Ave., Chicago, Ill., to handle distributions to the Canadian border, Colorado line, Mexican border and east to the center of Indiana. A staff of ten men will work out of the Chicago branch under the direction of L. B. Corwin.

Johns-Manville Inc., New York City, announces the election of the following officers at a recent meeting of the board of directors: T. F. Manville, chairman of the board; H. E. Manville, president; L. R. Hoff, vice president and general manager; W. R. Seigle, vice president and general manager or factories and mines; J. E. Meek, J. W. Perry and J. S. Carroll, vice presidents; A. C. Hoyt, secretary and treasurer; T. F. Manville, Jr., assistant secretary and treasurer. T. F. Manville, H. E. Manville, L. R. Hoff and W. R. Seigle compose the executive committee.

International Heater Co., Utica, N. Y., announces that H. J. Lichtenwalner of Elizabeth, N. J., has joined the company's sales force and will "cover" the trade in Northern New Jersey. It is announced also that G. R. Couch, of the firm of G. M. Couch & Sons, Hartford, Conn., has returned to the International's sales staff and will represent the company in southeastern Massachusetts, eastern Connecticut and Rhode Island.

EverHot Heater Sales Co., Los Angeles, Cal., has moved its offices to larger quarters at 1016 Santee Street.

Hart & Crouse Co., Utica, N. Y., is building a new foundry and other departmental additions to its plant at Utica. E. C. Stephens, vice-president, is in charge of sales since the resignation of Martin A. Rooney.

Hoffman Specialty Co., Waterbury, Conn., has transferred F. H. Gaylord from Minneapolis, Minn., to take charge of its offices at Pittsburgh, Pa., D. C. Jones succeeded Mr. Gaylord at Minneapolis.

General Electric Co., Schenectady, N. Y., has installed an electric steam generator in the Hudson Falls, N. Y. plant of the Union Bag & Paper Co. The generator is rated 5,000 kw., 6600-volt, 500 h. p. and is designed to generate steam at 100 lbs., pressure.

C. A. Dunham Co., Chicago, Ill., announces that both its No. 1 and No. 2 Dunham thermostatic radiator traps are now furnished with the standard dimension of 3¼ in. from center of trap body to face-of-inlet nipple. This complies with the standardization schedule compiled by the Heating and Piping Contractors' National Association for the roughing-in dimensions of radiator traps. The need for a closer standardization of roughing-in dimensions among manufacturers of heating specialties has long been apparent and the Dunham Company has manifested its intrest in the movement by being one of the first to conform to the new standard.

New Firms

Klein Heating Co., 584 Arcade Building, St. Louis, Mo., has been organized under the management of Walter A. Klein. Mr. Klein has been actively identified for many years with the heating and ventilating industry. In an announcement of the new company, he states that "we are in a position to offer a new and better service in connection with the installation of heating and ventilating systems."

Warner and Stewart Co., Cincinnati, O., has been formed through a consolidation of the Warner Engineering Co., and the Stewart Burner Ohio Co. J. H. Stewart is president of the company and C. S. Warner is vice-president and general manager. The company manufactures and installs oil-burning equipment

Brickham & Holford, Denver, Colo., is the name of a new firm of heating and ventilating engineers recently formed. The firm has headquarters in the U. S. National Bank Building, Denver.

PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools
Engineers—New York Board of Education.
Contractors—Federal Heating Co., New York City

LEHIGH MULTIBLADE FANS

FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior to, any other fans on the market.

HERSH BROTHERS CO.

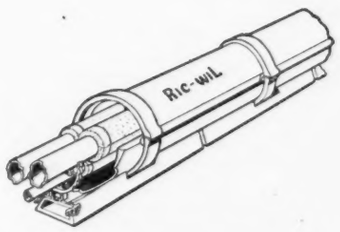
654 Mill Street **ALLENTOWN, PA.**

There isn't any "cheap" underground conduit

THERE is no doubt about it; it's engineering fact. Put your client's steam and hot water pipes out of sight in a make-shift conduit, and he has a spendthrift costing him in heat losses, repairs and replacement far more than RIC-WIL in the first place.

For RIC-WIL, a scientific conduit of proved commercial efficiency, of indestructible materials and perfected drainage, is as permanent as a power house--and as vital. And yet in many cases RIC-WIL costs no more than ordinary conduit.

Write for the facts about RIC-WIL genuine economy



6 Exclusive Advantages:

"Interlox" throughout;

Perfected base drain, cheaper, installed, than round drain, and far better;

Double drainage, internal and external, connected if desired;

Pipe supports that permit the economy of smaller conduit;

Permanent efficiency;

Easiest to install.

The New RIC-WIL Catalog

Just off the press, is a book of unusual value to Heating Engineers. It contains, among other things, a set of practical specifications to meet various conditions in the insulating of underground pipes.

Write for your copy

THE RIC-WIL COMPANY, 1570 UNION TRUST BLDG.
CLEVELAND, OHIO

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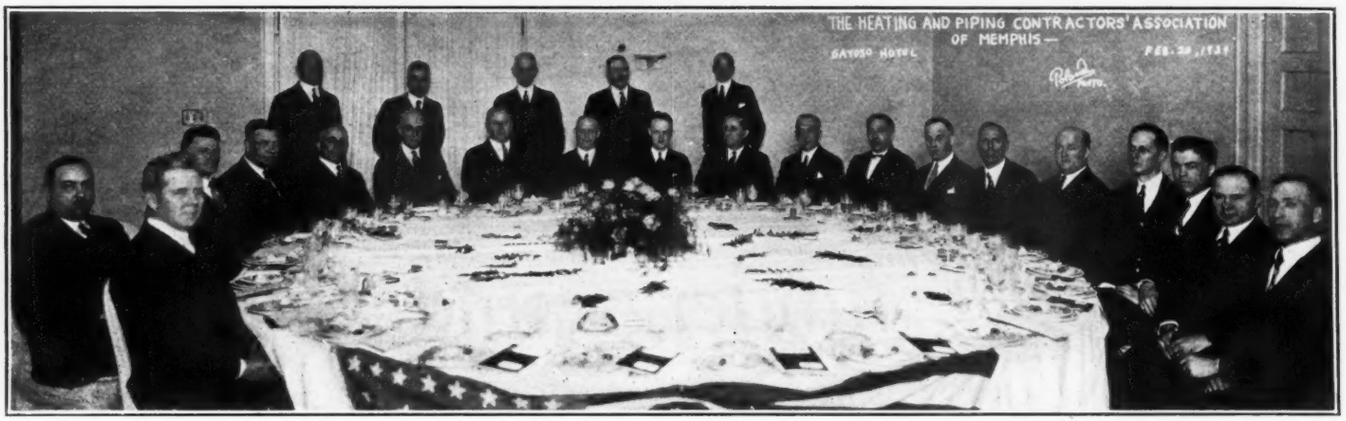
UNDERGROUND CONDUIT~~



Dinner of Heating and Piping Contractors' Memphis (Tenn.) Association

Heating and Piping Contractors Memphis (Tenn) Association has opened new headquarters in the business district of Memphis and is engaged, through committees in studying various problems such as standardizing installations, trades relations, advertising, credit systems, etc. The association has adopted the contract conditions recommended by the National Association, and the members are prohibited from signing or using any other contract. They are also prohibited from figuring or signing contracts with general contractors or any other than the architect, the owner or the owner's authorized agent.

New Incorporations

Nokol Heating Co., Memphis, Tenn., capital $100,000. Incorporators: W. T. Treikeld, J. D. Young and others.

Manchester Supply Co., Manchester, Mass., capital $175,000. William Hayes is manager.

Boston Electrical Heater Corporation, Whitman, Mass. Capital 1,000 shares of no par value. Incorporators: Donald B. Heath, Charles E. Lowell, and Harold L. Spooner.

Gibby Heater Co., Boston, Mass. Capital $50,000. Incorporators: Alfred E. Perrin, George H. Gibby and Arthur W. Gibby.

Tillinghast & Wentworth, Inc., Providence, R. I. Capital $100,000, to manufacture heating and cooking apparatus. Incorporators: Herbert D. Comey, Reading, Mass., Frederick A. Robinson, Roslindale, Mass., and Charles H. Comey, Waltham Mass.

Klein Heating Co., St. Louis, Mo., has been incorporated under the management of Walter A. Klein. Offices were opened at 584 Arcade Bldg., St. Louis, Mo.

Lyons Heating & Piping Co., 6402 S. Carpenter St., Chicago, Ill., capital $5,000. Incorporators: John W. Hackler, E. C. Lyons and Frank P. Jans.

Good Ventilation is Essential

Burt Glass Top Sliding Sleeve Damper Ventilator

And to be scientifically done is as difficult as it is essential.

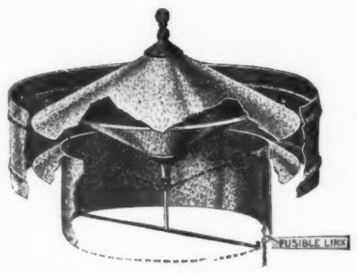
But every problem can be solved by our assortment of ventilators for every condition.

Specify Burt Ventilators and you will render your client a real service. Our engineers will gladly cooperate in selecting the proper style.

The Burt Manufacturing Co.

261 Main St., Akron, Ohio

Geo. W. Reed & Co., Montreal, Sole Manufacturer of Burt Ventilators for Canada.



Burt Fire Retarding Cone Damper Ventilator

SEE OUR DETAILED DATA IN ASH&VE GUIDE

MANUFACTURED WEATHER

makes

"Every day a *good* day"

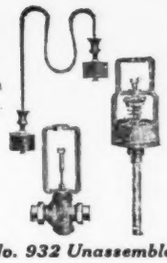
Humidification · Dehumidification
Heating · Ventilation · Purification
Drying

Carrier Engineering Corporation

750 Frelinghuysen Ave. Newark, N. J.

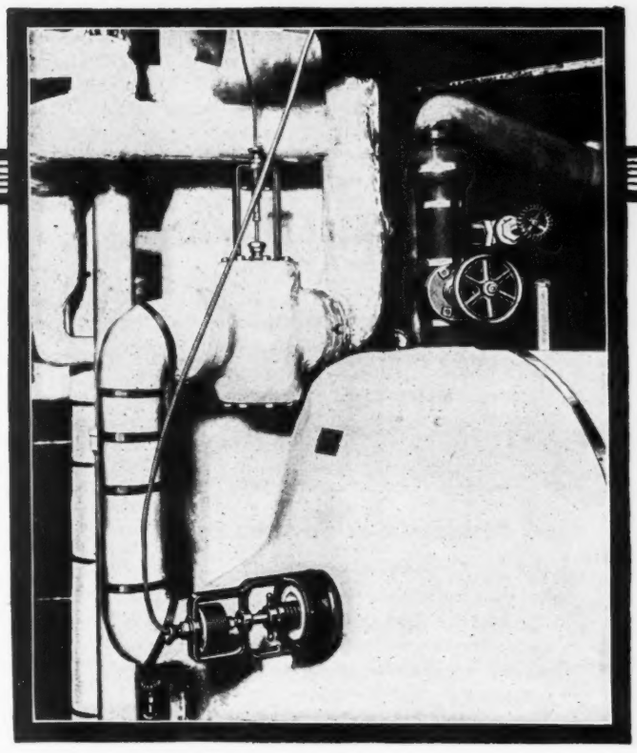
Boston · Buffalo · Chicago · New York · Philadelphia

SEE OUR DETAILED DATA IN ASH&VE GUIDE



No. 932 Unassembled

No. 932 Sylphon Temperature Regulator is just the Regulator for hot water supply tanks in Apartments, Hotels, Hospitals, Clubs, etc.



No. 932 Assembled

This 3 part Sylphon Regulator lifts the hoodoo from awkward installations

No matter how awkwardly steam line is placed—it may be jammed up against the ceiling, or there may be interferences near the hot water supply tank—this 3-part Sylphon Regulator can be easily installed. Only three operations are necessary. Install bulb separately in the tank, the valve separately in the steam line, then connect the two by slipping the power transmission unit into the detachable T-slot connections.

The power transmission unit (tube of which may be of any length) is filled with a non-freezing liquid. Movement is transmitted by pressure upon this liquid acting between two small Sylphon Bellows and is perfectly frictionless—no pullies, no wire cables.

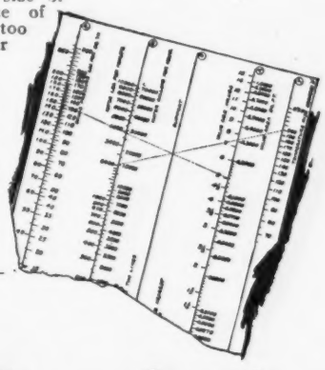
Gives close regulation because it contains the everlasting Seamless Sylphon Bellows

Since it contains, as its expansion member, the famous Sylphon Bellows, this No. 932, as all Sylphon Regulators, has guaranteed strength, long life, and flexibility where most Regulators are weak and stiff.

This Bellows, drawn from a flat sheet of metal, is *without soldered seams,* and because of this special construction and consequent flexibility, it not only gives close regulation, but also guarantees the widest possible throw to the valve, and thus tends to prevent wire drawing or steam cutting of valve seats.

Don't decide on size of regulator by size of pipe line, because too large a regulator not only costs more, but often cracks valve for small opening. We have prepared a Chart for Calculating Exact Sylphon Regulator Sizes. Let us send you one. It is **free.**

Ask for Chart WTR-103—



Temperature Regulators

THE FULTON COMPANY KNOXVILLE, TENN.

New York Chicago Detroit Boston Philadelphia

Representatives in All Principal Cities

European representatives:
Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W. I., England

Canadian representatives:
Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

Junction City Hardware Co. Inc., Junction City, Ore., capital $5,000, to engage in hardware, plumbing and heating business. Incorporators: R. A. Bobb, James R. Hughs, and E. Hughs.

Charles E. Ganin Co., 2251 Roscoe St., Chicago, Ill., capital $25,000, to conduct heating and plumbing business. Incorporators: I. P. Doyle, Anthony Dvorak and Charles E. Ganin.

Mahe Heating & Plumbing Co., Grand Junction, Colo., capital $10,000. Incorporators: J. I. Mahe, Margaret Mahe and Charles Garber.

Wayne Heater Corporation, Richmond, Ind., capital $250,000, to manufacture boilers. Incorporators: C. C. Fulghum, Richmond, Ind.; Fred Brunka, Marion, Ind.; C. E. Schulz and Joseph E. Crane, Dayton, O.; and Charles F. Wheeler, Cambridge City, Ind.

Chase & Lyman Inc., Boston, Mass., capital $100,000, to conduct a heating business. Incorporators: Curtis D. Chase, William B. Rice and Charles F. Lyman, Jr.

New Jersey Plumbing & Heating Co., Atlantic City, N. J., capital $125,000, to conduct a plumbing and gasfitting business.

The New Kieley & Mueller Trade-Mark

Kieley & Mueller, Inc., New York, dealers in steam, water and air specialties, whose latest catalogue was reviewed in last month's issue, have adopted a new trade-mark which has interesting features. The design takes the place of the old diamond-shaped trade-mark which has long identified this firm. The "balanced-valve" idea embodied in the new trade-mark has been cleverly carried out. A feature of the

KIELEY
REGISTERED TRADE MARK

new catalogue is in the compilation of the index whereby everything pertaining to one subject is listed together, rather than spread out in alphabetical order. The catalogue has been made of letter size so that it can be filed in the modern files as easily as on top of a desk.

Richardson & Boynton Sales Executives Meet

Many problems of interest to the heating and hardware trades were discussed at the recent meeting of sales executives of the Richardson & Boynton Co., at the company's general offices in New York. These included stability of price, individual attention, liberality of treatment and a constant high quality of product, all being considered from the viewpoint of dealer and customer protection.

The convention was concluded with a banquet at the Hotel Brevoort. Speakers at the conference included D. S. Richardson, who has completed 55 years with the company; W. R. Eaton, H. L. Anness of Boston, M. F. Gilbert of Philadelphia and A. H. Richardson of Chicago. D. Rait Richardson acted as master of ceremonies at the banquet.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

QUOTATION WANTED—Quote your lowest price C. O. D., subject to inspection, on the following used tools, which must be in first-class condition: One No. 2 and one No. 3 Toledo adjustable pipe threading device, one No. 250 and one No. 350 Toledo pipe cutter, two Toledo ratchet boring tools, with 1½-in., 2-in. and 2½-in. bits, one Toledo power drive, with 110-220-volt, 60-cycle, 3-phase motor, one No. 66 Reed or other make pipe vice, with capacity of 1½-in. to 12-in. pipe, one No. 100 Toledo P-D threading device, one Vosper pipe cutter. Address Box 32, care of Heating and Ventilating Magazine.

ENGINEER WANTED—A good position is offered with an old established brass manufacturing company to a competent sales and heating engineer to take charge of the line of vapor vacuum and steam specialties. Give experience and references in first letter. Address Box 41, care of Heating and Ventilating Magazine.

Class "QH"
type outlet connection is expanded twice diameter of inlet side.

FOSTER AUTOMATIC STEAM REGULATOR
for HEATING SYSTEMS
Class "Q" (and "QH")

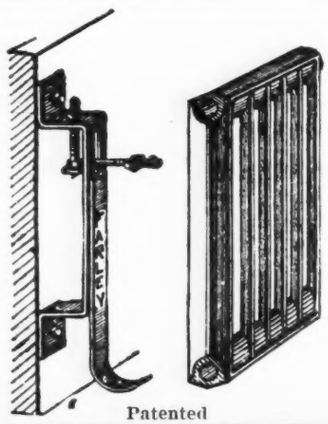
For "Steam-heating" and other service where the delivery pressure DOES NOT EXCEED 15 lbs. Sizes ¾" to 2" Q; ¾"x1½" to 2"x4" QH, composition bodies; larger sizes, iron body, composition trimmed—2½" and larger have renewable seats. Globe body only, screwed and flanged ends, furnished, if desired, with extra heavy inlet and standard outlet connections.

FOSTER ENGINEERING CO., NEWARK, N. J.

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION
LAFAYETTE BLDG.
PHILADELPHIA



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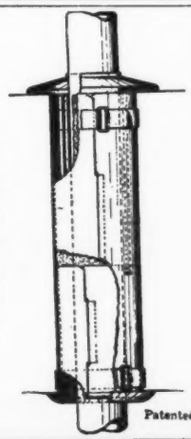
FARLEY
Hangers *and* Sleeves

This is the hanger you are looking for, made of hot rolled steel, will not break and made to fit any style of your radiation.

Fire resisting "Grab-on" sleeves are used in all classes of buildings. They are made to fit the condition of construction of the building. The only sleeve that will hold covering against the ceiling.



Patented

Send for descriptive literature

FARLEY SLEEVE AND HANGER COMPANY
3748 East 71st Street and Fleet Ave. Cleveland, Ohio